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DRAKE (C. J.) & RICHARDSON (C. H.). **Lucha contra la tucura en la Argentina.** [Grasshopper Control in Argentina.]—*Bol. Divulg. Soc. rur. argent.* no. 9, 41 pp., 34 figs. Buenos Aires, 1940. [Recd. 1942.]

Grasshoppers have caused considerable injury of recent years in Argentina. The most injurious species in the Province of Buenos Aires is *Trigonophymus* (*Dichroplus*) *arrogans*, Stål, with which are associated *T.* (*D.*) *elongatus*, Giglio-Tos, *T.* (*D.*) *conspersus*, Bruner, *T.* (*D.*) *pratensis*, Bruner, and *Scyllinops bruneri*, Rehn. The damage caused is most serious in pastures and lucerne fields [*cf. R.A.E.*, A **29** 511], but most crops are liable to injury, and the adult grasshoppers tend to concentrate on trees and cause mass defoliation in orchards. The tendency of the adults to form large swarms and to fly for long distances makes their control a national problem. The hoppers also have gregarious habits and form bands, although they are less dense than those of locust hoppers. Eggs are laid in hard uncultivated soil, and bare spots in pastures are preferred. The eggs of *T. arrogans* are described and all stages figured. The usual methods of preparing and applying poison baits are described in detail.

BEESON (C. F. C.). **A Guide to the Control of Termites for Forest Officers.**—*Indian For. Rec.* (N.S. Ent.) **4** no. 2 pp. 44–90, 9 figs., many refs. Delhi, 1941. Price 1*s.* 9*d.*

This paper, which contains information on termites of interest to forest officers in India, is a revision and amplification of one already noticed [*R.A.E.*, A **24** 94]. A short section deals with the bionomics of termites, and in others are described methods of protecting stored and converted timber and living trees, and the usual preventive and control methods recommended for buildings [*cf.* **17** 730, etc.], including the use of resistant timbers. Lists of resistant timbers native to India, Ceylon and Malaya are given, and building codes adopted or recommended in other countries are quoted.

Preventive measures in timber yards and mills include the provision of adequate drainage and the prevention of accumulations of sawdust and other débris. Timber that is not housed in sheds with paved, brick or concrete floors should be stacked, so as to allow adequate air-circulation, on supports of concrete or brick, on stone or iron rails, or on a wooden foundation treated with cresosote, the foundation pillars or walls being provided with metal termite shields where necessary. Where the stack is not made on permanent piers or other erection, the soil beneath it should first be soaked with waste engine oil, sludge or crude oil. Wooden structures and timber in contact with the ground must be protected by impregnation with creosote or similar oils, or with water-soluble antiseptics. Green fence posts can be treated by pouring a water-soluble antiseptic into a piece of inner tubing from a car tyre, about 2 ft. long, the end of which is forced over the butt end of the post from which the bark has been removed. The post is fixed butt end upwards. The treatment is complete when the concentration of the preservative emerging at the other end of the post is the same as that in the reservoir and the preservative is present throughout the cross-section of the lower end of the post. This treatment is most effective on freshly-felled timber, but the period that may elapse between felling and treatment depends on the season of the year. Timber soaked in a preservative in an open tank for several hours and then exposed to the air for several days remains resistant for not more than 2–4 times as long as untreated wood, and protection for a limited time can be obtained by slowly charring the ends of posts that are quite dry with a blow lamp. Poles of which the base is permanently buried should be treated under pressure with a good type of high-boiling creosote, the minimum effective absorption being 10 lb. creosote with the addition of 5 lb. fuel oil per cubic foot ; this treatment remains effective for an

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average of over 20 years and a possible maximum of 50–60. Treatment with high-boiling creosote in an open tank is recommended for timber with durable heartwood and sapwood that is easily penetrated under open tank conditions. A less effective measure is to brush the exposed heartwood at the end of the pole with preservatives [**30** 73], soak the pit in which it is to be erected with crude oil or creosote, and fill in the pit with soil saturated with oil. Brush treatment with water-soluble antiseptics does not afford reliable protection under out-door conditions.

When preparing sites for nurseries in cleared forest land, all woody surface débris should be removed, existing nests destroyed, and further invasion checked by digging a deep trench round the site. Wooden structures, such as edgings to seed-beds, should be treated with creosote, and all infested litter, humus and manure introduced into the nursery sterilised by spreading it in the sun or raking it over and compacting it. Certain kinds of oil-cake, such as castor, which have manurial value, are also mild deterrents. Transplanting should be performed promptly and carefully to avoid injury to or desiccation of the roots, which renders them susceptible to attack; under special circumstances, stumps or root-pruned transplants can be dipped in suspensions of lead arsenate or Paris green before planting out [**28** 3]. Small sowings of seeds should be made on ash beds rather than in soil containing leaf or woody litter. Termites infesting nursery beds can be controlled during the dry season by watering along the lines of plants with a weak emulsion of crude oil or fish oil; in irrigated nurseries and plantations, a sacking bag containing the emulsion can be suspended in the main irrigation channel to provide about 9 pints crude-oil emulsion per acre. Transplants or young saplings should be watered before and after the rains with an extract of tobacco leaves, a sodium-arsenite solution containing about 0·9 per cent. arsenious oxide, or a suspension of 1 lb. lead arsenate in 16 gals. water; after two years, the plants should be able to withstand attack. In the wet season, and where the soil is permanently moist, applications of Paris green or arsenious oxide diluted with several times their bulk of dry dust, sand or ashes in furrows along the lines of plants are effective. Termites are attacked by several species of ants, such as *Solenopsis geminata rufa*, Jerd., and if their nests are dug up and spread over the nursery beds, they will destroy any termites present.

An unusual type of injury sometimes occurs in saplings of trees that expand their bark by longitudinal cracks. Unusually rapid growth may cause the bark to split to the sapwood, and these fissures are invaded by termites, which prevent the wounds from healing and extend the dead areas until, in extreme cases, the stem is girdled and killed. The formation of such fissures can be prevented by regulating the overhead shade and thinnings to prevent rapid growth.

GOLDING (F. D.). **Locusts.**—*Farm & Forest* **2** no. 8 pp. 124–130, 6 refs. Ibadan, 1941.

This paper consists mainly of a popular account of the bionomics and outbreaks of locusts in Nigeria [*cf. R.A.E.*, A **19** 709; **20** 97; **22** 619; **23** 49], supplemented by data, based on a series of surveys [**26** 111, etc.], on their migrations in the outbreak areas as a whole. The outbreak of *Locusta migratoria migratorioides*, R. & F., which was intensive in 1938, terminated suddenly in 1939, possibly because of the exceptionally late onset of dry (harmattan) winds. No swarms of *Schistocerca gregaria*, Forsk., have been recorded in Nigeria since 1931, but in July 1940 the beginning of a new swarming period was suggested by the appearance of swarms in southern Algeria, 350–600 miles from the Nigerian border. The tree locust, *Anacridium moestum melanorhodon*, Wlk., occurs in swarms only north of 11°N. lat.; it is not of great importance but has been reported to cause some damage to *Citrus* and mango trees.

VAN DER MERWE (C. P.). **The *Citrus* Psylla (*Spanioza erytreae*, del G.).**—*Sci. Bull. Dep. Agric. S. Afr.* no. 233, 12 pp., 1 fig., 8 refs. Pretoria, 1941.

This bulletin on the bionomics and control of *Trioza* (*Spanioza*) *erytreae*, Del G. (*merwei*, Pettey) on *Citrus* in South Africa is a revision of a paper already noticed [*cf. R.A.E.*, A **11** 494]. In a note on the synonymy and distribution of this Psyllid [*cf.* **24** 650], it is pointed out that it is the species previously referred to as *T. citri*, Laing [**10** 391], but that no description under the latter name has been published. Of its natural enemies [*cf.* **11** 495], the small black Chalcidoid that parasitises the nymphs has been identified as a species of *Tetrastichus*, and it is suggested that it may possibly be *T. dryi*, Wtstn., which was bred from the Psyllid in Kenya [*cf.* **10** 391]. One of the Syrphids of which the larvae attack the nymphs has been identified as *Baccha helva*, Bez.

GEYER (J. W.). **The biological Control of the "Rondeblaar" Prickly Pear.**—*Fmg in S. Afr.* 1941 repr. no. 79, 4 pp., 10 figs. Pretoria, 1941.

The species of prickly-pear known locally as rondeblaar, and here called *Opuntia tardiospina* [*cf. R.A.E.*, A **30** 32], occurs extensively in parts of eastern Cape Province. It has proved to be immune from attack by *Cactoblastis cactorum*, Berg [*cf.* **28** 191], owing to its mucilaginous sap, or *Dactylopius coccus*, Costa, and its segments are so rapidly killed by the species of *Dactylopius* near *confusus*, Ckll., that this Coccid is unable to reproduce on it. *D. opuntiae*, Ckll., which gave promising results on it [*cf.* **30** 32], was liberated throughout the infested area and is giving excellent control. The crawlers settle on all segments of the plant, usually in sheltered positions, such as the base of the thorns, the joints of the segments or cracks of the bark, or on the fruit. The terminal segments of severely infested plants break off, and occasional regrowth from the basic segments is readily destroyed. Heavy rains, severe cold or very humid conditions have an adverse effect on *D. opuntiae*, but do not usually occur very frequently. Its most important natural enemies are the larvae and adults of the predacious Coccinellid, *Exochomus melanocephalus*, Zoubkoff (*nigromaculatus*, Goeze), which increased in numbers considerably during 1940–41 and is beginning to retard its progress. *Cryptolaemus montrouzieri*, Muls., which also attacks it [*cf.* **29** 17], has not been found in areas infested with rondeblaar pear. Differences in the appearance of the adult females of *D. coccus* and *D. opuntiae* are briefly described; the latter cannot easily be distinguished from the species near *confusus*, but it does not attack *O. aurantiaca*.

Protection of Wood on the Farm.—*Fmg in S. Afr.* 1941 repr. no. 84, 2 pp Pretoria, 1941.

This paper includes two sections, by G. J. Broekhuysen and F. G. C. Tooke, respectively, on the precautions necessary to prevent damage to timber by termites and by Lyctids and Bostrychids. In addition to attacking woodwork in buildings [*cf.* next abstract], *Macrotermes* (*Termes*) *natalensis*, Hav., *Termes latericius*, Hav., *T.* (*Odontotermes*) *badius*, Hav., and *M.* (*Bellicositermes*) *swaziae*, Fuller, cause damage in plantations, vineyards and gardens. All termite colonies should be destroyed [*cf.* next abstract] before the ground is disturbed, and plants and trees should be protected by digging out the soil round them to a width of 1–2 ft. and a depth of 1 ft., mixing it with 1–2 oz. lead arsenate, and replacing and watering it.

Termites in Buildings.—*Fmg in S. Afr.* 1941 repr. no. 86, 4 pp., 4 figs. Pretoria, 1941.

A brief account is given of the habits of the termites that damage buildings in South Africa, and methods of constructing houses to prevent injury by termites and of destroying the colonies are described [*cf. R.A.E.*, A **20** 269].

Damage to wallpaper and woodwork is usually caused by *Macrotermes natalensis*, Hav., *Termes* (*Odontotermes*) *badius*, Hav., *T. latericius*, Hav., *M.* (*T.*) *swaziae*, Fuller, and *M.* (*T.*) *bellicosus*, Smeath., of which the first three are the most injurious. Species of *Hodotermes* tunnel in the walls and also damage wallpaper [*cf. loc. cit.*]. *M. natalensis* and *T. latericius* are widely distributed in Natal and the Transvaal and also occur in the Orange Free State. *T. badius* is generally distributed in the Union; *M. swaziae* is confined mainly to the eastern low veldt; and *M. bellicosus* occurs chiefly to the north of the Zoutpansberg.

Houses should preferably be built of stone and burnt brick, and cement mortar should be used instead of clay. If open spaces below floors must be filled in, stones arranged so that no openings are available for nests should be used in place of earth. If it is necessary to use unbaked brick, the clay should be moistened with a solution of 1 lb. copper sulphate in 5 gals. water. The best way of rendering wood termite-proof is to immerse it in creosote at a temperature of 200°F. and leave it until the creosote is cool; similar treatment with a hot solution of copper sulphate or sodium arsenite affords some protection. Methods of destroying the colonies comprise fumigation with arsenic and sulphur [*cf.* **29** 338] or pushing a crowbar vertically through the mound until it reaches the fungus garden, pouring in 1–2 pints of petrol or 8–12 oz. carbon bisulphide, and sealing the hole.

CLARK (A. F.). **Termite Legislation in New Zealand.**—*N. Z. J. Sci. Tech.* **23** no. 1B pp. 23B–32B, 6 figs., 2 refs. Wellington, N.Z., 1942.

In order to make clear the necessity for the wide powers taken in the Termites Act 1940, a brief account is given of the problems arising in New Zealand from the establishment of the Australian subterranean termites, *Coptotermes acinaciformis*, Frogg., *C. lacteus*, Frogg., and *C. frenchi*, Hill, in Auckland and New Plymouth [*cf. R.A.E.*, A **28** 399]. *C. acinaciformis*, which readily adapts itself to conditions in built-up areas in New Zealand, is by far the most widespread species; the swarming period extends from November to March, and large flights have been observed. Severe damage is being caused to the timber of buildings, and trees, posts, stumps and tramway sleepers are also infested.

The legislation enables a house-to-house inspection to be made in infested districts. Building technique is to be modified and termite protection incorporated, and the sale of infested timber is prohibited. Provision is made for the application of chemical and other control measures, the former being carried out without charge.

WOMERSLEY (H.). **The Red-legged Earth-mite (Acarina, Penthaleidae) of Australia.**—*Trans. roy. Soc. S. Aust.* **65** pt. 2 pp. 292–294, 13 figs. Adelaide, 1941.

A key is given to the four genera of the PENTHALEIDAE, of which *Penthaleus* and *Halotydeus* are each represented in Australia by two species, *Stereotydeus* by three, and *Penthalodes* by a new one, which is here described. Characters distinguishing these species are shown. Those of economic importance are *Penthaleus major*, Dugès, on pasture and fodder crops and *Halotydeus destructor*, Tucker, on subterranean clover [*Trifolium subterraneum*] and vegetables.

LE PELLEY (R. H.). **The Food and Feeding Habits of *Antestia* in Kenya.**—*Bull. ent. Res.* **33** pt. 2 pp. 71–89, 2 pls., 1 fig., 24 refs. London, 1942.

The following is based on the author's summary and conclusions. In Kenya, *Antestia lineaticollis*, Stål, has three food-plants, *Coffea arabica*, *Psychotria nairobiensis* and *Pavetta elliottii*. Laboratory experiments showed that on coffee, red berries and large green berries are favoured foods, but feeding will

also take place on small green berries, shoots and leaves [*cf. R.A.E.*, A **26** 178] ; large green berries are essential for normal length of life and egg production. The Pentatomid was reared to the adult stage when fed exclusively on large green berries, on small green berries and on shoots, but not on red berries or leaves. In green berries, the endosperm becomes infected with rots, usually caused by the fungi, *Nematospora coryli* or *N. gossypii*, which are introduced by *Antestia*, but in the case of ripe red berries, the endocarp is seldom if ever pierced, and rotting of the endosperm is not initiated. The amount of damage caused to the crop by rotting of the beans is related to the number of bugs present, and a formula to represent this relationship is given. In practice, as high a proportion as 97 per cent. of the beans has been found to be infected when *Antestia* was numerous, and the figures also show that economic damage to the crop may occur even when the population is low. Injury caused by the feeding of the bugs includes dropping of the young green berries, apparently owing to interruption of the normal growth of the bean rather than to feeding on the stalk ; scarring and distortion of the leaves, when the growing point is attacked ; the non-setting of flowers, a form of damage that has been neglected or minimised in the past ; and multiple branching, which may result in bunchy or matted growth and so cause an increase in pruning costs and considerable reduction in the cropping ability of the tree. All the damage, except that to the leaves, is of economic importance, and a small population can cause heavy losses. In undisturbed conditions, a large increase in population can occur only during the growth of the berry, and does occur at this time unless inhibited by other factors, though the bug is present in all stages and reproduces throughout the year. It is likely to be most numerous when the coffee is ripe, and though it is probably least destructive at this time, its numbers should be reduced before the crop is harvested, or heavy feeding on the shoots will cause serious malformation of growth, which may prevent the cropping of the tree for more than a season. Intermittent flowering should be prevented, since the absence of large green berries during a definite season will inhibit reproduction.

GOMES (J. G.). **Moscas de frutas. 1—Espécies capturadas em frascos " caça-moscas " ; 2—Relação das espécies dos gêneros** *Anastrepha* **e** *Lucumaphila* **do Brasil. (Diptera : Trypetidae).** [Fruit-flies. 1. Species captured in glass Bait-traps. 2. List of Brazilian Species of *Anastrepha* and *Lucumaphila* (Trypetidae).]—*Bol. Soc. brasil. Agron.* **5** no. 1 pp. 26–37, 18 refs. Rio de Janeiro, 1942.

Owing to serious infestations of *Citrus* by fruit-flies in the State of Rio de Janeiro, the author enumerates in the first part of this paper (in many cases with notes on abundance) those caught in glass bait-traps in the plantations in 1936 and 1937 ; they comprised 12 species of *Anastrepha*, *Lucumaphila* (*A.*) *hamata*, Lw., *Ceratitis capitata*, Wied., *Hexachaeta aegiphilae*, Costa Lima, and the Lonchaeid, *Lonchaea pendula*, Bez.

The second part comprises lists of 58 species and 1 variety of *Anastrepha* and 6 species of *Lucumaphila* that occur in Brazil, together with their host-fruits when known, and of 9 species and varieties of *Anastrepha* that are considered by Stone [*R.A.E.*, A **30** 515] to be synonyms of some of the species recorded.

CORTÉS P. (R.). **Acerca del gén.** *Pantomorus* **Schoenh. (Col., Curculionidae) en Chile.** [Regarding the Genus *Pantomorus* in Chile.]—*Bol. Dep. Sanid. veg.* **1** (1941) no. 1 pp. 61–63, 4 refs. Santiago, Chile, 1942.

The weevils of the genus *Pantomorus* that occur in Chile are *P. godmani*, Crotch, which is an introduced species and is injurious to beans, potato, lucerne and fruit trees, *P. leucoloma*, Boh., *P.* (*Mimographus*) *ruizi*, Brèth., and an unidentified species reported in 1939 as injurious to fruit trees at Vallenar.

Brücher E. (G.). **Contribución preliminar al estudio de la polilla del frejol.** [A preliminary Contribution to the Study of *Epinotia opposita*, Heinr., infesting Beans.]—*Bol. Dep. Sanid. veg.* **1** (1941) no. 1 pp. 63–69, 4 refs. Santiago, Chile, 1942.

Epinotia opposita, Heinr., which was described from lucerne and cowpeas in Peru [*cf. R.A.E.*, A **19** 576], has been observed since 1932 infesting *Phaseolus* beans in Chile. It became widespread in the years following 1934 and was present in 1941 in almost all the bean-growing areas. Crop losses due to this Tortricid usually amount to 10–20 per cent., but in 1940–41 they ranged up to 50 per cent. It is not known to attack any other plant in Chile. Descriptions are given of all stages and of its bionomics. It is thought to overwinter as a pupa in the soil, and adults are present in October. Eggs are laid on the leaves and shoots, and, when they appear, on the pods. The larvae of the first generation feed on the leaves and mine the stems. After 18–20 days they descend to the ground by means of threads and pupate in the soil. The adults emerge 15–16 days later and oviposit after 3–6 days. The larvae hatch in 2–3 days, and those of this and the succeeding generations attack the pods. They penetrate to the seeds, sometimes emptying them, and several may occur in a single pod. There appear to be three or four generations during the bean season from October to April. Several unidentified Braconids possibly parasitise the larvae or pupae.

Mujica R. (F.). **Nómina de las enfermedades y pestes de la papa cuya existencia se ha comprobado en el país.** [A List of Diseases and Pests of Potato recorded in Chile.]—*Bol. Dep. Sanid. veg.* **1** (1941) no. 1 pp. 70–72. Santiago, Chile, 1942.

Principales plagas agrícolas producidas por insectos y otros animales que fueron objeto de consulta en el primer semestre (Enero-Junio) de 1941. [The principal Injuries to Crops caused by Insects and other Animals that were reported in Chile from January to June 1941.]—*T. c.* pp. 75–78.

The first list includes insects and virus diseases. In the second, the insects are recorded with their food-plants and the localities in which they were observed.

Hayward (K. J.). **La polilla de la papa** (*Gnorimoschema operculella* **Zeller) y su control.** [The Potato Moth and its Control.]—*Circ. Estac. exp. agríc. Tucumán* no. 108, 11 pp., 5 figs. Tucumán, 1942.

An outbreak of *Gnorimoschema operculella*, Zell., occurred on potato in Tucumán, North Argentina, in the spring of 1941 ; it was the first on record in the Province and extended to all the potato growing districts. The larvae were parasitised by several species of undescribed Hymenoptera. The bionomics of this Tineid and methods of controlling it are reviewed.

Douglas (W. A.) & Ingram (J. W.). **Rice-field Insects.**—*Circ. U. S. Dep. Agric.* no. 632, 32 pp., 21 figs., 4 refs. Washington, D.C., 1942.

Insect damage to growing rice in the southern United States is caused mainly by *Solubea pugnax*, F., *Diatraea saccharalis*, F., *Chilo plejadellus*, Zinck., and *Euetheola rugiceps*, Lec. All stages of these insects (except the pupa of *Euetheola*) are described. Severe losses result from attack by adults and nymphs of *S. pugnax* [*cf. R.A.E.*, A **27** 537], which feed on rice kernels in the milk and dough stages, causing the condition known as " pecky " rice. When the grain is in the milk stage, the entire contents may be sucked out, leaving an empty seed coat. Statistics for the years 1930–37 indicate that 99 per cent. of all damaged kernels in Louisiana, Texas and Arkansas are pecky, with a consequent

average annual reduction in crop value of over $473,000. A list is given of the wild food-plants of this Pentatomid, of which the most important is *Paspalum urvillei*. The eggs, particularly those of the autumn generation, are parasitised by *Ooencyrtus anasae*, Ashm., and *Telenomus podisi*, Ashm., while winter cold kills many of the hibernating adults. Burning or ploughing under heavy grasses in autumn or winter also destroys many bugs.

The larvae of *D. saccharalis*, which is a major pest of sugar-cane and maize in Louisiana, eastern Texas and Florida [*cf.* **30** 412], and *C. plejadellus*, which occurs in Georgia and is less numerous, feed within the stalks of rice, causing the panicles to turn white and produce no grain. If the injury occurs when the panicle is completely exserted from the sheath, it partly matures, but uniform development of the seed is prevented, and the resulting grains mill badly and have a reduced germinating power. During the growing season the rice stalks are weakened by the tunnelling and heavy losses from lodging result, particularly in windy weather. In late-sown rice, many young plants are so severely damaged just above the water line that the tops break off, large stemmed varieties suffering most severely. The bionomics of the two species are similar, and are briefly summarised, and lists of their food-plants are given. Owing to the slight protection from cold afforded by rice stalks, reduced infestation follows severe winters. The hibernating larvae can be controlled by pasturing, ploughing, flooding or burning rice stubble [*cf.* **30** 413].

The adults of *Euetheola rugiceps* attack rice in all the southern rice-producing States, but this Dynastid does not occur in California ; the most severe injury observed was in south-western Louisiana, especially in the northern portion of the rice area, where fields are scattered among large areas of heavily pastured sod land that affords food for the larvae. The occurrence of sporadic outbreaks in fields that are surrounded by rice-fields or other crops indicates that the beetles may fly for considerable distances. The bionomics of the Dynastid are briefly described [*cf.* **28** 247]. The beetles gnaw the plants just below the surface of the soil, often killing and stunting them and causing the stalks to fall over. Natural enemies include many birds, skunks, armadillos, *Bufo lentiginosus* and *Rana catesbiana*. The adult beetles are parasitised by *Sarcophaga rapax*, Wlk., and the larvae by *Microphthalma disjuncta*, Wied. The treatment of rice seed with kerosene or commercial coal tar effectively repelled the beetles under controlled conditions, and both materials continued to give off fumes during the 15 days that are allowed for dry growth prior to submerging ; no injury to germination or growth was observed. The seed was treated with kerosene at the rate of ½ U.S. gal. per bushel and kept in a container overnight ; the coal tar was applied by pouring it in a small stream into a container of seed, which was stirred until it was coated. Road dust or flour should be added to overcome the stickiness of the tar, and about 1 U.S. quart commercial coal tar suffices to treat a bushel of seed. These treatments might be of value under certain conditions, but fields should be watched closely and irrigation water applied as soon as injured plants appear. No treatment has been found that will repel the beetles in autumn after the fields are drained. Where injury by them is common, draining should be delayed as long as possible, as they do not attack rice so long as the soil is covered with water. Elimination of sod land is advantageous.

The roots of rice plants are commonly attacked by the larvae, and the leaves by the adults, of *Lissorhoptrus simplex*, Say, all stages and the life-history of which are described. The larvae have been considered to cause considerable injury to the plants [*cf.* **24** 116, etc.], but cage experiments in Louisiana in 1924–26 showed that infestation resulted in no decrease in total weight of grain produced or in the weight of 100 husked grains, and in further work there in 1934–39, draining the fields to kill the larvae resulted in decreased yields as compared with continuously flooded plots. Other minor pests of rice are *Paromius longulus*, Dall., *Laphygma frugiperda*, S. & A., *Diabrotica duodecimpunctata*, F., *Blissus leucopterus*, Say, and *Systena frontalis*, F. No serious

injury by insects has been recorded in Californian rice-fields, but a list of insects that are of potential importance in them is given.

Walker (H. G.) & Anderson (L. D.). **Notes on the Control of the Fuller's Rose Weevil,** *Pantomorus godmani* **(Crotch) on Kale.** (Abstract.)—*Virginia J. Sci.* **1** no. 7 p. 206. Lexington, Va., 1940. [Recd. 1942.]

This is the report of an experiment on the control of an outbreak of *Pantomorus godmani*, Crotch, in a field of kale in Virginia. A derris-talc dust containing 0·75 per cent. rotenone killed 26 per cent. of the weevils. A pyrethrum-talc dust containing 0·2 per cent. pyrethrins affected almost all the weevils within 30 minutes, but 77 per cent. recovered and continued to feed on the treated plants. A dust containing about 40 per cent. calcium arsenate, 10 per cent. Paris green and 50 per cent. hydrated lime killed 85 per cent. An undiluted calcium arsenate dust killed 94 per cent. The difference between the two calcium-arsenate dusts was not significant, but those between these dusts and the others were highly so.

Current Contributions on Insect Control.—*Bull. N. Y. St. agric. Exp. Sta.* no. 698, 62 pp., 9 figs., 7 refs. Geneva, N.Y., 1942.

This bulletin contains the following reports of investigations in progress in New York State.

Carruth (L. A.). **Present Status of the Mineral Oil Treatment for Corn Ear Worm Control,** pp. 3–5, 2 refs. The mineral oils most suitable for injection into the ears of sweet maize against larvae of *Heliothis armigera*, Hb., were found to be those with a viscosity of 175–210 seconds (Saybolt 100°F); lighter oils retarded the development of the grains at the tip of the ear. The percentage of pyrethrum or dichloroethyl ether to be incorporated into the oil can probably be reduced to 0·1 per cent. pyrethrins and 1 per cent. dichloroethyl ether [*cf. R.A.E.*, A **30** 26], and an application of 0·5–0·6 cc. of the combined insecticide per ear, made 6–7 days after the first appearance of the silks, is thought to be adequate. Excessive dosages injure the ears.

Smith (E. H.) & Daniel (D. M.). **The Status of biological Control of the Japanese Beetle in New York State,** pp. 6–9, 2 figs. *Popillia japonica*,, Newm., is most abundant in the metropolitan area of New York, but has spread to the north and west. Thirty-one colonies of *Tiphia popilliavora*, Rohw., were released against the larvae in 1938–39 and 149 of *T. vernalis*, Rohw., in 1939–41, each colony consisting of 100 mated females. Preliminary observations indicate that the establishment of both parasites is possible under the prevailing environmental conditions. Since there was no indication of the presence of milky disease in the metropolitan area in 1938, the distribution of dust containing spores of *Bacillus popilliae* [**29** 369] was begun in 1939. By the end of 1941, 373 plots, covering an area of over 186 acres, had been treated, and a survey in that year indicated that the disease was well-established in plots treated in 1940.

Dean (R. W.). **Pyrethrum Dusts for the Control of the Apple Redbug,** pp. 10–11. In tests of pyrethrum in calyx sprays against *Lygidea mendax*, Reut., on apple in eastern New York as a substitute for nicotine sulphate [**24** 277], which is ineffective at low temperatures, as well as costly and toxic to some operators, powdered pyrethrum flowers were less, and pyrethrum extracts sometimes more effective than nicotine sulphate, but both lost much of their toxicity when combined with wettable sulphur or liquid lime-sulphur. In 1938, a dust of 10 lb. Dry Pyrocide (2 per cent. pyrethrins [**28** 624]), 10 lb. lead arsenate, 40 lb. sulphur and 30 lb. clay gave almost as good control (91·51 per cent.) as a spray of 2 U.S. gals. lime-sulphur, 3 lb. lead arsenate, 3 lb. hydrated lime, 1 U.S.

pint nicotine sulphate and water to make 100 U.S. gals. (93·93 per cent.), but was too heavy to possess good dusting properties. In 1940, when pyrophyllite was substituted for clay and the quantity of sulphur increased to 50 lb., 96·56 per cent. control was obtained, whereas that given by the spray was only 65·79 per cent. and that by a dust containing 2 per cent. nicotine and lime was 92·53 per cent. In 1941, the control percentages were 41·77 with the dust of 2 per cent. nicotine and lime, 98·26 with 7½ lb. Dry Pyrocide in 92½ lb. pyrophyllite, 100 with 10 lb. Dry Pyrocide in 90 lb. pyrophyllite, 99·23 with 25 lb. Stimtox A (0·5 per cent. pyrethrins), 74¾ lb. snuff-mill sweepings (which gave 0·125 per cent. nicotine in the dust) and ¼ lb. Aresket, and 98·22 with a spray of 1 U.S. pint nicotine sulphate and 3 lb. hydrated lime in 100 U.S. gals. Pyrethrum dusts were more satisfactory than pyrethrum sprays and were effective at temperatures lower than those at which nicotine can be used, but are nearly twice as costly as a home-made dust of 2 per cent. nicotine and lime.

Glasgow (H.). **The Use of concentrated Sprays for Pea Aphid Control,** pp. 12–14, 1 fig. Tests with concentrated sprays against the pea Aphid [*Macrosiphum onobrychis*, Boy.] on peas have been carried out in New York over a period of five years. Application by aeroplane did not prove satisfactory. The special ground equipment evolved was operated by direct pressure from a standard unit and delivered a very finely divided spray through nozzles that were arranged in such a manner that the boom could pass close to the plants to compensate for the lack of supplementary air-blast. The boom was protected with a metal hood, and a canvas trailer increased the effectiveness of water-borne sprays. The trailer was not employed, however, in the typical experiment here described, which was carried out in 1941 and in which vaporised nicotine and a rotenone dust were used for comparison. Treatment was begun when the number of Aphids taken in 10 sweeps of a net exceeded 5,000 and was completed on 9th June ; control was estimated on 18th June, when population samples on untreated plots had fallen to 2,848. The percentages by which the population was reduced were 94 for a concentrated spray containing 1½ gals. 80 per cent. free nicotine, 9 gals. rotenone extract (2½ per cent. rotenone) and 89½ gals. oil (35 seconds viscosity) applied at the rate of 5 U.S. gals. per acre, 92·7 for 80 per cent. free nicotine vaporised at the rate of 3 lb. per acre, 86·5 for a concentrated spray of 1⅞ U.S. gals. nicotine sulphate and 18 lb. soap in 96 U.S. gals. water applied at the rate of 20 U.S. gals. per acre, 79·8 for one containing 3¼ gals. rotenone extract (2½ per cent. rotenone) in 96¼ gals. water, applied at the same rate, and 79·3 for a dust containing 1 per cent. rotenone and 2 per cent. soy-bean oil with pyrophyllite as the carrier.

Pearce (G. W.) & Chapman (P. J.). **Blood Albumin for Use as an Emulsifier,** pp. 15–16. In view of the promising results given by blood albumin as an emulsifier for tank-mixed dormant oil sprays [*cf.* **30** 95], specifications are suggested for an acceptable grade. These are a total nitrogen content of 14·0± 0·5 per cent. ; a solubility in water of not less than 90 per cent., and a degree of fineness such that not less than 90 per cent. will pass through a 100-mesh screen. Commercial preparations usually contain 1 part blood albumin in 3 of an inert carrier such as diatomaceous earth. Recent tests have shown that blood albumin is a satisfactory emulsifier for tank-mixed summer oils, and may also be of value as a wetting and spreading agent in other sprays.

Harman (S. W.). **Contributions to Codling Moth Control,** pp. 17–19. In tests over a period of five years in an orchard in western New York, the percentage infestation of apples by the codling moth [*Cydia pomonella*, L.] was less than 1 following a spray programme designed to give complete control of the first-generation larvae. This comprised a calyx and one or two cover sprays containing lead arsenate, followed by a spray of oil and nicotine applied at intervals of 7–10 days until there was no further risk of attack. In alternate years, when no sprays were applied, the crop was almost a total loss. To obtain such effective control the trees should be well pruned and the fruit thinned where

necessary, spraying should be performed with modern equipment, preferably with lights to enable work to be carried on at night and capable of covering the entire planting in two or three days, and adjoining orchards should be well kept, or plantings separated by about 200 yards of open field. Spraying by night allows advantage to be taken of conditions of dead calm, under which the nicotine has a fumigating effect seldom possible by day. The fumes persist and apparently kill all active insects, as they disappear from the orchard for at least a week.

Previous attempts to use rotenone in sprays against *C. pomonella* were unsuccessful, but in tests begun in 1938 powdered rotenone-bearing roots gave promising results, and with the addition of a spreader and adhesive were more effective than sprays of nicotine or lead arsenate. Rotenone extracts were not effective. A spray containing 1 U.S. quart summer oil, 1 lb. lead arsenate and 2½ lb. powdered root (4·8 per cent. rotenone) in 100 U.S. gals. gave 99·1 per cent. control and is considered likely to be of value as a combined spray against *C. pomonella* and the apple maggot [*Rhagoletis pomonella*, Walsh].

In 1940, hatching of first-generation larvae of *C. pomonella*, which normally does not reach its peak until July when the fruits have the protection built up from two cover sprays, was exceptionally heavy in June as a result of unusually warm weather. The outbreak was completely controlled by incorporating nicotine sulphate in the lead-arsenate cover spray, and cooler weather then set in. In 1941, the inclusion of nicotine sulphate in the lead-arsenate cover spray increased its effectiveness from 94·7 to 98·3 per cent. in one orchard, and in another a cover spray containing 1 lb. lead arsenate and 1 U.S. pint nicotine sulphate in 100 U.S. gals. gave 97·4 per cent. control as compared with 97·7 per cent. for one containing 3 lb. lead arsenate in 100 U.S. gals.

Hervey (G. E. R.). **Squash Vine Borer Control,** pp. 20–21. In tests during 1937–41 of the value of rotenone against the squash vine borer [*Melittia satyriniformis*, Hb.], treatments were applied during the oviposition period, starting about 1st July. Four weekly applications were made in 1937, 1938 and 1941, and five in 1939 and 1940, the first two covering the whole plant and the later ones an area about 2 ft. in diameter round the centre of the hill. Satisfactory commercial control was given by a 1 per cent. rotenone dust and by a spray of 2 U.S. quarts nicotine sulphate or 4 lb. powdered derris root (5 per cent. rotenone) in 100 U.S. gals. When the proportion of derris was reduced to 1 or ½ lb., there were marked reductions in control. Commercial rotenone extracts in sprays, a 25 per cent. lead-arsenate dust and sprays containing lead arsenate, alone or with Bordeaux mixture, or calcium arsenate were of little value, but some protection was afforded by a dual-fixed nicotine dust containing 4 per cent. nicotine. Rotenone dusts and derris sprays are also effective against the striped cucumber beetle [*Diabrotica melanocephala*, F.].

Gambrell (F. L.). **Dormant Treatments for the Control of certain Insects on Nursery Plants,** pp. 22–25, 1 ref. The results are given of tests over a number of years with dormant sprays, notably mixtures containing dinitro compounds, against Coccids and Aphids on ornamental trees and shrubs. In general, dinitro compounds in oil injured the foliage of most conifers, but not that of lilac, willow and snowball (*Viburnum* spp.). Elgetol, a preparation containing sodium dinitro-ortho-cresylate and penetrants, at concentrations of ½ and 1 U.S. gal. in 100 U.S. gals. spray (equivalent to 13·8 and 27·5 oz. dinitro-o-cresol, respectively) injured the foliage of some conifers, but not that of Mugho or white pine [*Pinus mugo* and *P. strobus*]. Norway and white spruce [*Picea abies* and *P. glauca*], Jeffrey, Scots and red pine [*Pinus jeffreyi*, *P. sylvestris* and *P. resinosa*] and Mugho and white pine were not injured by a spray in which Elgetol was replaced by 1 U.S. gal. Stantol (a preparation containing the sodium salt without penetrants and equivalent, at this concentration, to 42 oz. dinitro-o-cresol). Satisfactory control of the lilac form of *Lepidosaphes ulmi*, L., which is more resistant to dormant sprays than

the apple form, was given by 3–3·75 U.S. gals. petroleum oil (viscosity 108 seconds Saybolt) with 18·8–24 oz. dinitro-o-cresol or dinitro-o-cyclohexylphenol, and 2 U.S. gals. Elgetol with 4 U.S. gals. lubricating oil, both in 100 U.S. gals. spray, and fair control was given by the same quantity of Elgetol in water. Promising results were obtained with a tank mixture of 48 oz. of a powder containing dinitro-o-cresol fused with bentonite (2 : 3) with the addition of 39 oz. potassium hydroxide in 100 U.S. gals. water. None of these sprays was injurious to lilac when applied before the separation of the bud scales. In general, satisfactory control of *Chermes* (*Adelges*) *abietis*, Kalt., on spruce was given by sprays containing dinitro-o-cresol or dinitro-o-cyclohexylphenol in lubricating oil (1·6 oz. in ¼ U.S. gal. per 100 U.S. gals.) or suspended in water (4 oz. in 100 U.S. gals.), Elgetol (¼ and 1 in 100) and Stantol (1 in 100), but all except Stantol and the suspensions injured the foliage of Norway spruce and Colorado blue spruce [*Picea pungens*]. Dormant sprays containing Elgetol (¼ in 100) or about 4·7 oz. dinitro-o-cyclohexylphenol or dinitro-o-cresol suspended in 100 U.S. gals. water or dissolved in 1 gal. lubricating oil (1 in 100) were effective against *Anuraphis eriophori*, Wlk. (*Aphis viburnicola*, Gill.) on *Viburnum* and did not injure the trees. A spray of 0·25 per cent. nicotine sulphate with 1 per cent. potash fish-oil soap applied at the green-tip stage was fairly effective against *A. eriophori* when properly timed with regard to the hatching of the eggs and mild weather, and gave good control of *C. abietis*. A dormant spray of lubricating oil alone was not effective against *A. eriophori*.

Smith (E. H.) Avens (A. W.) & Mendall (S. C.). **Relation of Oil Deposits to the Control of the Oriental Fruit Moth on Quinces,** pp. 26–28, 1 fig., 1 ref. Since parasites do not control the oriental fruit moth [*Cydia molesta*, Busck] on quince, an investigation was begun in 1941 on the value of oil and nicotine sprays, which in the past have not been consistently satisfactory. Fortnightly applications were made on heavily infested trees that had received a calyx spray and two cover sprays of lead arsenate. The sprays contained 1 U.S. pint nicotine sulphate (Black Leaf 40) and either 4 U.S. quarts of a proprietary summer oil emulsion containing about 75 per cent. oil or 1, 2 or 3 U.S. quarts of a tank-mixed oil of high paraffinic character derived by a solvent process and with a viscosity of 79 seconds (Saybolt 100°F.) emulsified with 2 oz. blood albumin in 100 U.S. gals. water, and the percentages of control were 86·1, 75·4, 83·3 and 86·6, respectively. The quantity of oil deposited on the foliage showed little reduction between treatments, and a cumulative increase with each application. The greatest control, however, appears to occur immediately after an application, and control may therefore be facilitated by reducing the interval between treatments.

Mundinger (F. G.). **Insecticidal Control of the Raspberry Cane Borer,** pp. 29–30. Following preliminary tests in 1939, experiments were made in 1941 on the control of *Oberea bimaculata*, Ol., on raspberry [**30** 55] in western New York by means of insecticides. One or two applications were made on raspberry canes on 10th or 10th and 26th June, and the results were estimated from the percentages of canes damaged in comparison with an untreated plot. The best results were given by a spray containing 5 lb. ground derris root (4·8 per cent. rotenone) and ½ lb. soy-bean meal per 100 U.S. gals., one application of which gave 90·8 and two 87·2 per cent. control. One or two applications of a 1 per cent. rotenone dust and two of a spray containing 1 pint of a commercial rotenone extract (2·5 per cent. rotenone) in 100 gals. were less effective, and one and two of a spray containing 3 lb. of a fixed nicotine (Black Leaf 155) and ½ lb. soy-bean meal in 100 U.S. gals. gave only 55·3 and 51·1 per cent. control. In some seasons, a single treatment for *O. bimaculata* is also effective against *Agrilus ruficollis*, F., and *A. rubicola*, Abeille. Treatments with insecticides are probably most effective when applied as soon as the first flowers open, and thorough coverage of the whole plant is necessary.

Huckett (H. C.). **Pea Aphids as a Factor in growing Peas on Long Island,** p. 31. The cultivation of peas on Long Island has become unprofitable in recent years owing to infestation by the pea Aphid [*Macrosiphum onobrychis*, Boy.] and to pea mosaic [*Marmor leguminosarum* of Holmes], which it transmits. Data collected over a period of three years indicate that seedlings are susceptible to attack as soon as they appear in late April. Infestation remained below 10 per cent., populations were low, and only isolated cases of pea mosaic occurred before late May. Where infestation and mosaic infection became severe, this occurred during a period of much warmer weather than is normal during the greater part of May, when the plants were in bloom and within three weeks of harvest. One or two applications of a 1 per cent. rotenone dust or a spray containing 4 lb. powdered derris root (4–5 per cent. rotenone) in 100 U.S. gals. water with a spreader, made 2–4 weeks before harvest, often resulted in increased yield.

Hammer (O. H.) & Hamilton (D. W.). **A shortened, intensive Summer Spray Program for Apples in eastern New York,** pp. 32–34. A combined spray schedule tested in 1941 for the control of the codling moth [*Cydia pomonella*, L.] and the apple maggot [*Rhagoletis pomonella*, Walsh] on apple was designed to eliminate treatment against second-generation larvae of *C. pomonella* in July and August. The trees, which were heavily infested by *C. pomonella*, were sprayed thoroughly from the ground and the larger ones were also sprayed from above ; about 1 U.S. gal. spray was used for each bushel of fruit that the trees were capable of bearing. Five applications were made, on 16th and 28th May, 9th–10th and 18th–19th June, and 1st July. With the exception of the fourth spray, all contained 3 lb. lead arsenate, 3 lb. spray lime and $\frac{1}{4}$ lb. powdered skim milk per 100 U.S. gals. The first spray also contained 4 lb. sulphur, and the second and third were reinforced with $\frac{3}{4}$ and $\frac{1}{2}$ U.S. pint nicotine sulphate, respectively, with a view to killing the adults and newly hatched larvae of *Cydia*. The fourth spray was directed chiefly against *Cydia* and consisted of $1\frac{1}{2}$ lb. fixed nicotine (Black Leaf 155 Concentrate, 14 per cent. nicotine) and 2 U.S. quarts summer oil per 100 U.S. gals. ; the fifth was directed against *Rhagoletis*. This schedule gave commercial control of *C. pomonella* ; 94·54 per cent. of the fruits were uninjured and only 2·14 per cent. infested. The residues of arsenic and lead were below the legal tolerance [**30** 308]. Similar tests in other orchards indicated that the schedule is effective against light infestations of *R. pomonella*, but that a sixth application might be necessary for heavy ones. The lead and arsenic residues on fruit that received such applications on 14th July were below the legal tolerance when a spray containing 3 lb. calcium arsenate per 100 U.S. gals. was used, but not where lead arsenate was applied at this concentration or as a 20 per cent. dust. If second-generation larvae of *C. pomonella* become numerous in early August, a prompt application of a nicotine spray should be effective.

Carruth (L. A.). **Use of Dusts for European Corn Borer Control,** pp. 35–39, 3 figs., 1 ref. A small population of the European corn borer [*Pyrausta nubilalis*, Hb.] is constantly present on sweet maize in most areas of New York State, and serious outbreaks may occur where favourable conditions arise. The most satisfactory control measure available appears to be four applications at five-day intervals of a dust containing dual-fixed nicotine or 1 per cent. rotenone, which resulted in yields of 86·5 and 81·6 per cent. uninfested ears, respectively, when applied with a wheelbarrow duster, and 90·3 and 89·2 per cent. when applied with a tractor duster. Treatment is usually begun in early June in the eastern part of the State, and nearly a month later in the centre and in the north. The financial gain to be derived from dusting is discussed.

Chapman (P. J.), Pearce (G. W.) & Avens (A. W.). **A new Basis for selecting Petroleum Oils for Orchard Sprays,** pp. 40–42, 1 ref. Some of the results are given of an attempt to correlate the physical properties of petroleum oils with their insecticidal properties, carried out in order to determine the

most effective type for use in dormant and semi-dormant sprays on deciduous fruit-trees. Forty different oils with viscosities of 90–125 seconds Saybolt, obtained from various oil-producing areas of the United States and derived by different processes, were emulsified with blood albumin and tested in an orchard against the eggs of the fruit-tree leaf-roller [*Tortrix argyrospila*, Wlk.] on apple in 1941. The data obtained indicated that oils of almost the same viscosity may differ markedly in toxicity, and that the latter is correlated with the properties of gravity and the viscosity index [an empirical number that indicates the effect of temperature change on viscosity], which in turn are directly related to the paraffinic character of the oil. In view of the need for some standard other than viscosity, the authors suggest tentative additional specifications for dormant spray oils; these comprise a kinematic viscosity index of at least 65, a gravity in A.P.I. degrees of at least 28, and a pour point not greater than 30°F.; the oil should represent a relatively narrow boiling distillate portion of petroleum and should have a viscosity of 90–120 secs. Saybolt at 100°F. The data also indicate that, if all oils are equally toxic to fruit trees, less injury will result from the use of those with high insecticidal properties, since they can be applied at lower concentrations. Preliminary work on summer oils of 60–70 seconds viscosity, tested against the codling moth [*Cydia pomonella*, L.] and the oriental fruit moth [*C. molesta*, Busck] on quince, indicated a similar relationship between effectiveness and chemical composition; such oils should be of a distinctly paraffinic nature and have an unsulphonated residue above 90 per cent.

Hamilton (D. W.). **Recent Investigations on Cherry Fruitflies,** pp. 43–44. Field trials were made during 1937–40 with substitutes for lead arsenate in the cover sprays applied against the adults of *Rhagoletis cingulata*, Lw., and *R. fausta*, O.-S., on cherry in the Hudson Valley, since the lead and arsenic residues left on the fruits were excessive and washing was inconvenient in the case of cherries to be sold as fresh fruit. The best results were given by three applications of a spray containing 2 lb. derris or cubé (5 per cent. rotenone), 4 lb. micronised wettable sulphur (as a fungicide) and ¼ lb. soy-bean flour in 100 U.S. gals. water [*cf.* **29** 196]; the application should be synchronised with the emergence of *R. cingulata*. In Columbia County in the last five years this has begun between 4th and 11th June and ended between 24th June and 8th July; the first application should therefore be made about 10th June, and the others at intervals of 8–10 days. *R. fausta* emerges between 26th May and 14th June and is relatively less abundant when *R. cingulata* is present; it is partly controlled by the earlier sepal-fall spray of lead arsenate, and was never observed on the late-maturing English Morello cherries.

Taschenberg (E. F.) & Hartzell (F. Z.). **Studies on the Control of the Grapeberry Moth,** pp. 45–47, 1 fig. *Polychrosis viteana*, Clem., has increased in abundance and range on vines in western New York State since 1937. Infestation is generally heavier near Lake Erie than on the gravelly ridges farther inland, and varies within a single vineyard, possibly with the degree of shelter afforded to the pupae, which overwinter on the surface of the ground, by the snow cover, the depth of which depends on the presence or absence of wind-breaks; infestation was observed to be greatest where snow had accumulated during the winter. Attempts were made in 1939–41 to develop a schedule of sprays that would avoid excessive arsenical residues of the grapes, and satisfactory results were given by two applications o calcium arsenate with Bordeaux mixture as an arsenical corrective followed by two of fixed nicotine. The formulae were 3 lb. calcium arsenate, 2 lb. copper sulphate, 4 lb. hydrated lime, 2 lb. resin fish-oil soap and ½ U.S. pint kerosene per 100 U.S. gals., and 3 lb. Black Leaf 155 Concentrate (14 per cent. nicotine) and 8 oz. resin fish-oil soap per 100 U.S. gals. This schedule gave an average percentage control of 79·1 and did not leave excessive deposits at harvest. The substitution of ground derris root (4 per cent. rotenone) at the rate of

4 lb. per 100 U.S. gals. for the fixed nicotine resulted in as good results, and four applications of fixed nicotine in even better. The spray should be applied at the rate of 175–200 U.S. gals. per acre. The first treatment should be made immediately after flowering, the second 10 days later, the third, directed against the second generation, between the last week of July and the second week of August, and the fourth 10 days after the third. If infestation is light, only three, and if it is heavy as many as five, applications may be necessary. The spraying equipment used was fitted with a boom capable of providing adequate coverage on both sides of a row in one operation, and was provided with a hood to nullify the effect of wind.

Hervey (G. E. R.). **Studies of Rotenone Sprays for Cabbage Worm Control,** pp. 48–50, 1 fig. Tests were carried out in 1941 in which the effectiveness of two proprietary rotenone extracts, NNOR (1 per cent. rotenone [*cf.* **30** 198]) and Syntone (2·8 per cent. rotenone), against larvae of the imported cabbage worm [*Pieris rapae*, L.] and the cabbage looper [*Plusia brassicae*, Ril.] was compared with that of the standard spray of derris. For purposes of comparison, the amount of derris (4·8 per cent. rotenone and 16 per cent. total extractives) in the latter was reduced from 4 to 1 lb. per 100 U.S. gals., and the extracts were diluted to give comparable rotenone strengths. A commercial derris suspension was also tested. The sprays were applied at the rate of approximately 180 U.S. gals. per acre and at a pressure of 300 lb. on 6th, 14th and 28th August, when *Pieris rapae* was the predominant species, *Plusia brassicae* becoming more abundant in September. Counts were made on 3rd September, when there was little difference in the effectiveness of the sprays, and on 9th October, when all plants were attacked but the percentage only lightly injured was greatest on the plot sprayed with derris powder. Syntone, NNOR and the proprietary suspension were decreasingly effective in the order named. Derris at the full strength (4 lb. per 100 gals.) was superior to all the treatments.

Hammer (O. H.). **Recent Experiments to control the Scurfy Scale,** pp. 51–52. In experiments in 1939–41, over 97 per cent. control of *Chionaspis furfura*, Fitch, on apple was given by dormant tank-mixed sprays containing 3 per cent. of a paraffin-type oil emulsified with blood albumin and used with or without the addition of 8 or 10 oz. dinitro-ortho-cyclohexylphenol, 9·6 oz. dinitro-o-cresol, or Elgetol (sodium dinitro-o-cresylate) at a rate equivalent to 13·8 oz. dinitro-o-cresol, but 3 or 6 per cent. oil emulsified with lignin pitch or sprays containing the dinitro compounds without oil were less effective. The addition of the dinitro-compounds appears to be unnecessary for the control of *C. furfura*, but is desirable when a combined spray against *C. furfura*, the bud moth [*Spilonota ocellana*, Schiff.] and Aphids is required. None of the materials permanently injured the trees at the concentrations used, but development was retarded to some extent by concentrations of oil above 3 per cent.

Dean (R. W.) & Smith (E. H.). **Insecticides for Oriental Fruit Moth Control,** pp. 53–54, 1 ref. In tests to determine the value of a dust containing 5 per cent. petroleum oil, 57 per cent. sulphur and 38 per cent. inert ingredients, and sprays containing 2 lb. xanthone or 3 lb. fixed nicotine (14 per cent. nicotine) per 100 U.S. gals. in controlling the oriental fruit moth [*Cydia molesta*, Busck] on peach in the Hudson Valley in 1941, none of the materials tested was superior, either in the degree of control or the avoidance of unsightly residues, to those tested by Daniel [**19** 363]. It is concluded that the use of insecticides against this pest on peach is not justified in New York State.

Greenwood (D. E.). **Field Identification of five Leaf Rollers found in Apple Orchards,** pp. 55–58. Studies were made on the morphology and bionomics of leaf-rollers that feed on apple in western New York with a view to affording means of distinguishing the larvae of *Tortrix* (*Cacoecia*) *argyrospila*, Wlk., and *Eulia velutinana*, Wlk., which are of economic importance, from those of other Tortricids present in the orchards at about the same time. Differences in the morphology and bionomics of the eggs, larvae and adults of these two species and

those of *T.* (*Pandemis*) *limitata*, Rob., *T.* (*C.*) *rosaceana*, Harr., and *Eulia quadrifasciana*, Fern., are shown in a table. Other trees are attacked by the larvae of all these species, but the morphological characters given for the eggs and larvae are based on specimens reared on apple. Species with similar larval characters can be most easily distinguished by the time of their appearance on apple. The thoracic shields and heads of the immature larvae of *T. argyrospila* and *T. rosaceana* are almost identical, but larvae of the latter overwinter, and have already completed the third or fourth instar when those of the former are hatching. Larvae of all five species are distinguished by their flattened bodies from those of *Grapholitha* spp., in which the body is cylindrical.

Hartzell (F. Z.). **Pre-foliage Treatments for Control of Bud Moth,** pp. 59–62. During 1936–41, 118 spray formulae were tested against *Spilonota ocellana*, Schiff., on apple in western New York State [*cf.* **26** 562; **27** 535; **29** 127]; the results of the most promising combinations are shown in tables. Dinitro-ortho-cresol in oil and its sodium salt in water applied as dormant sprays are less injurious to the buds and twigs than dinitro-ortho-cyclohexylphenol in oil; the best control (99 per cent.) was given by a spray of 1 U.S. gal. Elgetol (27·5 oz. dinitro-ortho-cresol as the sodium salt) and 3 U.S. gals. oil in 100 U.S. gals., but this was about as injurious to the buds as dinitro-cyclo-hexylphenol in oil, and there was also some risk of bud injury when dinitro-o-cresol was used in 3 per cent. oil. Sodium dinitro-o-cresylate in water is also effective against Aphids and the oyster-shell scale [*Lepidosaphes ulmi*, L.] and is less toxic to lateral buds than dinitro-o-cresol in oil; it is therefore often preferable to the latter in the absence of such pests as San José scale [*Aspidiotus perniciosus*, Comst.], fruit-tree leaf-roller [*Tortrix argyrospila*, Wlk.] and red mite [*Paratetranychus pilosus*, C. & F.], but the content of dinitro-o-cresol should be 1½–2 times that used in oil. In tests over a period of three years, trees sprayed at the green-tip stage with Elgetol at concentrations not exceeding 0·75 per cent. (21 oz. dinitro-o-cresol per 100 U.S. gals.) or with tank-mixed water-soluble cresylates in which the content of dinitro-o-cresol did not exceed 12 oz. in 100 U.S. gals. were not injured. Sprays containing nicotine sulphate were less effective than those containing dinitro compounds, but can be safely applied at the green-tip stage when combined with lubricating oil and at the early delayed dormant stage when combined with lime-sulphur. The most effective concentrations were 0·25 per cent. nicotine sulphate and 3 per cent. lubricating oil or 2½ per cent. lime-sulphur.

Will (H. C.). **Sawfly Infestations in Pennsylvania.**—*Proc. Pa Acad. Sci.* **16** pp. 47–51, 4 figs., 2 refs. [Harrisburg, Pa.] 1942.

Instances are given of the occurrence in Pennsylvania of *Arge macleayi*, Leach, on hazel (*Corylus*), *Amauronematus azaleae*, Marlatt, on azalea in a greenhouse, and *Neodiprion lecontei*, Fitch, on pine. The larvae of all three sawflies are described.

Reinmuth (E.). **Zur Maikäferbekämpfung. Mecklenburgische Erfahrungen und Beobachtungen im Maikäferjahr 1938.** [May Beetle Control. Experiences and Observations in the Flight Year 1938.]—*Z. PflKrankh.* **52** pt. 5 pp. 241–249. Stuttgart, 1942.

A main flight of *Melolontha melolontha*, L., was expected in Mecklenburg in 1938, but owing to cold weather it did not begin until 13th May. Pairing was observed on 14th and oviposition on 24th May. A few beetles were still present in mid-July. Particulars are given of the variations in size and weight of the beetles, which were considerable. Undersized individuals paired and oviposited normally, and males and females occurred in approximately equal numbers.

A collecting campaign was organised, but the results were poor owing to lack of helpers. Only six million beetles were collected over an experimental area of some 67½ square miles, and it is considered that this figure represented only a small fraction of the entire population. In preliminary tests, neither ploughing immediately prior to oviposition nor the use of stable manure had any practical influence on the number of larvae per unit area, but infestation was notably increased in soil to which sulphate of ammonia or quicklime had been applied, either mixed or separately. Of young larvae found in the ground from 20th to 26th and 27th to 31st October, the percentages at depths of 0–4, 4–8, 8–12, 12–16 and 16–20 ins. were, respectively, 5·4 and 0·5, 13·4 and 8·3, 40·3 and 40·8, 30·3 and 42·4, and 10·6 and 8·0.

Neu (W.). **Der Maikäferflug an der Bergstrasse 1941.** [May Beetle Flight in the Bergstrasse Region in 1941.]—*Z. PflKrankh.* **52** pt. 5 pp. 249–261, 2 figs., 11 refs. Stuttgart, 1942.

Details are given of the course of the flight of *Melolontha melolontha*, L., and *M. hippocastani*, F., in the Bergstrasse region north of Heidelberg in 1941. In the previous main flight year (1938), the flight reached its maximum on 6th May and the first of the three oviposition flights occurred on 15th May. In 1941, temperatures were abnormally low in April and May and rain was frequent. Emergence from the soil was erratic, so that birds gave considerable control. There was no mass flight, and oviposition did not reach its maximum until the end of May. It is not known whether females made more than one oviposition flight. Activity depended on the weather and was stopped by rain. *M. melolontha* required a temperature of at least 8°C. [46·4°F.] for evening flight, and a daily mean temperature at least as high. *M. hippocastani* required a lower daily mean temperature, and thus was the first to fly. Details are given of the local distribution of the two species and of the average numbers of eggs deposited.

Listo (J.), Listo (E. M.) & Kanervo (V.). **Tutkimuksia hedelmäpuupunkista** (*Paratetranychus pilosus* **C. u. F.**). [A Study on the Fruit-tree Mite.]—*Valt. Maataloush. Julk.* no. 99, 143 pp., 32 figs. Helsinki, 1939. (With a Summary in English.) (Abstr. in *Z. PflKrankh.* **52** pt. 5 p. 275. Stuttgart, 1942.)

Paratetranychus pilosus, C. & F., occurs on many kinds of fruit and other trees in central and southern Finland, apple and plum being preferred. In warm years there may be five generations. *Stethorus* (*Scymnus*) *punctillum*, Weise, and *Oligota flavicornis*, Erichson, are the most promising of 15 natural enemies discussed.

Bitter (B.) & Niklas (O. F.). **Die Massenvermehrung der Kiefernbuschhornblattwespe** *Pteronus* (=*Lophyrus*) *pini* **L. im Forstamt Trappen (Trappönen), Ostpreussen, 1936–1937.** [The Mass Increase of *Diprion pini*, L., in the Trappen Forestry District, East Prussia, in 1936–37.]—*Forstwiss. Zbl.* **61** pp. 429–447. 1939. (Abstr. in *Z. PflKrankh.* **52** pt. 5 p. 277. Stuttgart, 1942.)

An outbreak of *Diprion* (*Pteronus*) *pini*, L., began in 1936 on pines in the Trappen forestry district, East Prussia. Cocoon counts in the summer indicated that it would increase further, but though it did so in the areas that had been slightly attacked, those that had been severely injured were not attacked again, probably because parasitism of the eggs was high and the surviving larvae migrated owing to lack of food. In attempts at control, Effusan (a dust containing dinitro-cresol) proved effective though slow in action, but Naaki (silica

dust) was of no value. In the following winter, parasites and diseases greatly reduced the population. The pines withstood the injury well, especially in the dusted areas.

ECKSTEIN (K.). **Die " Abbrüche " des Waldgärtners,** *Myelophilus piniperda* **L.** [Broken Shoots due to *M. piniperda*.]—*Forstwiss. Zbl.* **61** pp. 33–42, 81–92. 1939. (Abstr. in *Z. PflKrankh.* **52** pt. 5 p. 277. Stuttgart, 1942.)

The collection of pine shoots that had broken off owing to injury by the adults of *Myelophilus piniperda*, L., showed that vigorous, open stands of old trees are preferred. Injury to the shoots by *M. minor*, Htg., or *M. piniperda* can be distinguished from that due to *Pityophthorus glabratus*, Eichh., by the irregular course of the mine made by the latter. *Ips acuminatus*, Gylh., also makes feeding mines in pine shoots.

PUSTER (—). **Alte und neue Verfahren der Maikäferbekämpfung im Wirtschaftswalde.** [Old and new Methods against May Beetles in economic Forests.]—*Forstwiss. Zbl.* **61** pp. 493–505. 1939. (Abstr. in *Z. Pfl-Krankh.* **52** pt. 5 pp. 277–278. Stuttgart, 1942.)

From 40 years' experience in the control of May beetles [*Melolontha*] by hand collection, the author disputes the view that this method is inferior to dusting with dinitro-cresol [*cf. R.A.E.*, A **27** 606]. In a dense, deciduous forest near Karlsruhe, it has continued to prove effective. In open stands, the requisite catch of 86 per cent. of the adults cannot be achieved, and the natural increase of population leads to migration. Destruction of the foliage is the chief drawback to the use of dinitro-cresol. Work in the flight year 1939 showed that collection was preferable, though in some cases dusting proved a valuable supplementary measure.

GÄBLER (H.). **Notnahrung der Nonnenraupen.** [Abnormal Food of Nun Moth Larvae.]—*Tharandt. forstl. Jb.* **90** pp. 783–793. 1939. (Abstr. in *Z. PflKrankh.* **52** pt. 5 p. 279. Stuttgart, 1942.)

Where topography is a hindrance to dusting, an outbreak of *Lymantria monacha*, L., can, if recognised in good time, be controlled to some extent by banding the trees with an adhesive that prevents the larvae from ascending them. In experiments to discover whether individuals thus deprived of their normal food are able to develop on low-growing plants, the only ones on which the larvae fed readily were *Vaccinium myrtillus* and *V. vitis-idaea*. It is concluded, therefore, that banding is of value in all stands except those with an undergrowth of *Vaccinium*. Polyhedral disease occurred in larvae given unsuitable food to a greater extent than in those fed on pine or spruce.

KRETOVICH (V. L.) & TOKAREVA (R. R.). **Diagnostik des durch** *Eurygaster integriceps* **beschädigten Kornes.** [The Recognition of Grain damaged by *E. integriceps*.]—*C. R. Acad. Sci. URSS* (N.S.) **27** no. 6 pp. 571–574, 8 refs. Moscow, 1940. [Recd. 1942.]

It is impossible by superficial examination of grain to distinguish wheat damaged by *Eurygaster integriceps*, Put., from that injured by *Haplothrips tritici*, Kurdj. For this reason, wheat damaged by the thrips may be rejected, although the quality of the flour milled from it is satisfactory. The authors, therefore, describe a method by means of which grain damaged by *Eurygaster* can be distinguished by the excessive ductibility of a preparation of the gluten.

KREUTZBERG (V. E.). **A new Virus Disease of** *Pistacia vera* **L.**—*C. R. Acad. Sci. URSS* (N.S.) **27** no. 6 pp. 614–617, 3 figs. Moscow, 1940. [Recd. 1942.]

An account is given of the symptoms of a virus disease of the rosette type observed in pistachio (*Pistacia vera*) in Turkmenistan, Uzbekistan and Tadzhikistan in 1935–37. It reduced the total yield of pistachio plantations in the Kushkinskaya forest by 34·72 per cent. and the yield of the infected trees by 45·2 per cent. It was transmitted through the seed and by a species of *Liothrips*, here called *pistaciae*, sp. n., but not described. The progeny of infected females were not infective. It was not transmitted through pollen or juice. Recommendations for its control comprise the removal of affected branches when the crowns are cleared and trimmed, and the use of cuttings and seed taken only from healthy trees.

[SEMENOV (A. E.) & OGLOBLIN (D. A.).] **Семенов (А. Е.) и Оглоблин (Д. А.). Two new Species of Beetles feeding on Leaves of Almond.** [*In Russian.*]—*Proc. Lenin Acad. agric. Sci. U.S.S.R.* **6** no. 1 pp. 20–23, 4 figs. Moscow, 1941.

Descriptions by Ogloblin are given in Russian and English of the adults of the Eumolpid, *Lefevrella amygdali*, sp. n., and the Galerucid, *Luperus flavilabris*, sp. n., which were taken on sweet cultivated almond, in Tadzhikistan, and, in Russian only, of the first-instar larva of the former. These beetles are apparently widely distributed throughout the lower forest zone of the mountains in Tadzhikistan and were observed in considerable numbers in non-irrigated orchards in a gorge on the southern slopes of the Hissar ridge at an altitude of some 3,600 ft.

Lefevrella amygdali occurred only on the southern slope of the gorge, where the ground was stony and the vegetation sparse. It apparently has one generation a year, and the adults hibernate. They appeared early in spring and at the end of April or beginning of May fed on the leaves of almond and plums. In the insectary they also readily attacked the foliage of wild almond. They fly readily, but drop to the ground when disturbed. They were abundant throughout May, but disappeared in mid-June. Pairing was intense in the first half of May. In the insectary, oviposition started on 6th June and the eggs hatched in 24 days. The habits and food of the larvae were not ascertained. *Luperus flavilabris* was present only on the northern slopes of the gorge, which were covered with vegetation. The adults appeared on wild and cultivated almonds in mid-May and fed on the leaves until the end of June. Oviposition occurred at the beginning of June.

[LUISENKO (T. D.).] **Лысенко (Т. Д.). Regarding the Control of the Weevil.** [*In Russian.*]—*Proc. Lenin Acad. agric. Sci. U.S.S.R.* **6** no. 5 pp. 3–10. Moscow, 1941.

The author emphasises the importance of sowing at the best times if good crops are to be obtained, discusses the best time for sowing sugar-beet in the Ukraine, and reviews measures for the control of the beet weevil [*Cleonus punctiventris*, Germ.]. These comprise the use of trap ditches [*cf. R.A.E.*, A **29** 577], fowls [*cf.* **30** 374] and trap plots of beet. Trap plots should occupy about 4 per cent. of the total area under beet and should be sown as early as possible in spring to attract the overwintered weevils. The main crop should not be sown until the beet in the trap plots shows above ground. These plots should be surrounded by a deep trap ditch, and fowls should be allowed to run in them before the beet is above ground to destroy any weevils that may emerge. They should be ploughed up in June, to destroy any larvae in the soil.

Fowls should be allowed to feed in old beet fields as soon as the weevils begin to emerge from the soil in spring. Emergence continues for 10–20 days or more. Each fowl is able to destroy some 700–1,400 weevils a day, so that if the density of the weevils is 12·5 per sq. yd. (a very high figure) 3–4 hens will clear an acre in 15–20 days.

[Semenov (A. E.) & Gerasimov (A. M.).] **Семенов (А. Е.) и Герасимов (А. М.). *Neoris schenki* Stgr.—a new Pest of Garden Crops in Regions under dry Farming System.** [*In Russian.*]—*Proc. Lenin Acad. agric. Sci. U.S.S.R.* **6** no. 6 pp. 26–29, 2 figs., 1 ref. Moscow, 1941.

Descriptions are given of the adults (from the literature), mature larva and female pupa of *Neoris schenki*, Stgr., the larvae of which feed on the leaves of many kinds of deciduous trees and cause considerable damage in non-irrigated orchards on the southern slopes of the Hissar mountains in Tadzhikistan. This Saturniid occurs only in the mountainous regions of Kazakstan, Uzbekistan and Tadzhikistan. Observations in Tadzhikistan in 1939–40 showed that there is one generation a year and hibernation occurs in the egg stage. The adults are present at the end of September and the beginning of October. The overwintered eggs hatched at the beginning of April and the larvae developed quickly and were very voracious. Their food-plants, a list of which is given, included plum, peach, apricot and almonds. Pupation took place during June and the first half of July on plants close to the ground, and the pupal stage lasted about 4 months. In the laboratory, the adults emerged from 27th September till 15th October.

[Zhukovskiĭ (A. V.).] **Жуковский (А. В.). Forecasts of Outbreaks of the Hessian Fly.** [*In Russian.*]—*Proc. Lenin Acad. agric. Sci. U.S.S.R.* **6** no. 7 pp. 14–15. Moscow, 1941.

On the basis of observations during an outbreak of the Hessian fly [*Mayetiola destructor*, Say] on cereals in the Province of Voronezh in 1937–40, it is concluded that the chief points to be considered in forecasting possible outbreaks of this fly are the abundance and size of the hibernating pupae, and the kinds of fields in which they occur. Land that has borne winter wheat is usually ploughed in the autumn following harvest, which destroys the pupae, but that used for spring wheat is left fallow in the following autumn and becomes a source of infestation in spring. The size of the pupae was closely correlated with the fertility of the resultant females and was dependent on larval feeding, varying inversely with the number of larvae feeding in the same stem. In the laboratory, the fertility of females bred from larvae that fed at the rate of 8 per stem of wheat was only one-tenth that of females from those that were bred at the rate of 1 per stem.

Other factors that have a bearing on the abundance of the fly are temperature, rain, wind and parasites. Maximum emergence under experimental conditions occurred at 12–15°C. [53·6–59°F.], and this temperature is about the average in Voronezh during the first 10 days of May, when the adults of the overwintered generation are emerging. The larvae are more susceptible to low temperatures, and their development in spring is retarded at a mean of 14–15°C. [57·2–59°F.] or below. Young larvae that hatch from eggs laid by females that emerge in September are killed by the cold. Many larvae are washed off the leaves by rain, and wind forces the adults to concentrate in depressions and on plots where protection is afforded by forest, which results in uneven infestation. The control afforded by parasites is sometimes sufficient to terminate an outbreak [*cf.* **29** 582].

[Bogatova (Z. K.).] **Богатова (З. К.). Effect of Extracting Agent, Method of Extraction and Carrier on the Toxicity of** *Tephrosia* **Extracts.** [*In Russian.*]—*Proc. Lenin Acad. agric. Sci. U.S.S.R.* **6** no. 9 pp. 21–25, 2 refs. Moscow, 1941.

The tests described were carried out on *Brevicoryne* (*Aphis*) *brassicae*, L., by a method already noticed [*R.A.E.*, A **13** 158]. The extracts were redissolved in the same or another solvent (here called the carrier) before being diluted for use. When chloroform extracts of different parts of plants of *Tephrosia candida*, at approximately the same concentration of extractives, were dissolved in acetone and tested on the Aphid, the percentages of mortality 48 hours after treatment were 6·62, 9·65 and 81·25 per cent. for leaves, roots and stems, respectively, and these results were superior to those given by *Tephrosia* sp. and *T. vogeli*.

In further experiments with these three species of *Tephrosia* to determine the best solvent and carrier, extracts obtained by extraction with chloroform, carbon tetrachloride, trichlorethylene or ethylene dichloride (dichlorethane) proved more toxic than those prepared with benzene or benzine [*cf.* **29** 586]. Extracts prepared with ethyl alcohol or methyl alcohol, which, unlike the other solvents, are soluble in water, were the least effective. The toxicity of the extracts increased when they were redissolved in kerosene or transformer oil. The hot method of extraction in a Soxhlet apparatus was more effective than infusion at room temperature, except in the case of the stems of *T. candida*, which also gave a high rate of mortality when extracted by infusion. In further tests, the stems of *Tephrosia* sp. and the stems and leaves of *T. vogeli* were extracted twice (the second time with chloroform) and the extracts were then dissolved in transformer oil. Benzine extracts showed low toxicity, which was probably due to the low effectiveness of benzine as a solvent for the active principle, since subsequent treatment of the residue with chloroform yielded a considerable amount of additional toxic material. Extraction of stems or leaves of *T. vogeli* with the two alcohols also yielded materials of low toxicity but evidently produced changes in the active principle, as the toxicity of the chloroform extracts of the residues was also low. In the case of the stems of *Tephrosia* sp., however, ethyl alcohol failed to extract any toxic components, but did not alter them, as subsequent treatment with chloroform gave extracts of high toxicity.

[Mardzhanyan (G. M.).] **Марджанян (Г. М.). The Question of the toxic Characters of different** *Pyrethrum* **Species.** [*In Russian.*]—*Proc. Lenin Acad. agric. Sci. U.S.S.R.* **6** no. 10 pp. 26–29, 8 refs. Moscow, 1941.

In connection with the cultivation of *Chrysanthemum* (*Pyrethrum*) *cinerariaefolium* in the Russian Union, chemical analyses were made by several methods of 14 other species of the same genus and 3 of related genera, all of which grow wild in Armenia. The toxicity of dusts prepared from these plants was then tested on larvae of *Pieris brassicae*, L., the rate of application being 3–5 mg. per sq. cm. The pyrethrin contents of the plants, as indicated by various methods of analysis, are shown in a table. Dusts of *C. cinerariaefolium*, *C. roseum*, *C. carneum* and *C. tamrutense* gave complete mortality of the larvae in 48 hours, those of *C. szowitssi*, *C. balsamita* and *C. chyliophyllum* caused the larvae to regurgitate but did not kill them, and those from the other plants had no effect on them. Toxicity was related to pyrethrin content in only a few cases, and *C. macrophyllum* [*cf. R.A.E.*, A **20** 198] was completely inert. *C. tamrutense*, which equalled *C. cinerariaefolium* in toxicity, is highly xerophilous and is suitable for cultivation in arid zones. *C. roseum* and *C. carneum* were, in general, as toxic as *C. cinerariaefolium*, and in one instance *C. roseum* proved even more so. It is emphasised that the degree of toxicity of an

insecticidal plant is closely connected with ecological conditions, and factors that assist the accumulation of pyrethrins should be investigated.

[Ivanova-Aleksandrovskaya (Z. V.).] **Иванова-Александровская (З. В.). Effect of Chlorpicrin on the Germination Capacity of Cotton Seeds.** [*In Russian.*]—*Proc. Lenin Acad. agric. Sci. U.S.S.R.* **6** no. 11 pp. 24–26. Moscow, 1941.

In the experiments described, seeds of Egyptian and American cotton having moisture contents of 8·7 and 9·1 per cent., respectively, were fumigated with chloropicrin at rates equivalent to 2, 6 and 7 fl. oz. per 100 cu. ft. and in an atmosphere saturated with the fumigant. The temperature varied from 15 to 18°C. [59–64·4°F.] and the exposure lasted 24 hours. The germinating power of the seeds was affected only by the saturated atmosphere, whereas fumigation at rates of 1·8–2 fl. oz. per 100 cu. ft. is completely effective against the pink bollworm [*Platyedra gossypiella*, Saund.] and 2–3 fl. oz. against other cotton pests. Seeds punctured in three places lost all their germinating power after fumigation. The resistance to fumigation of the seeds of Egyptian cotton decreased as their moisture content rose from 7·25 to 14·9 per cent., but fumigation at temperatures of 12–41°C. [53·6–105·8°F.] had no effect on germination.

[Zazhurilo (V. K.) & Sitnikova (G. M.).] **Зажурило (В. К.) и Ситникова (Г. М.). Inter-relation between the Virus of Mosaic Disease of Winter Wheat and its Vector** (*Deltocephalus striatus* **L.).** [*In Russian.*]—*Proc. Lenin Acad. agric. Sci. U.S.S.R.* **6** no. 11 pp. 27–29, 3 refs. Moscow, 1941.

In further investigations, carried out in the Province of Voronezh in 1940, the mosaic disease of cereals [*cf. R.A.E.*, A **29** 15, 617] was again transmitted from infected to healthy plants by *Laevicephalus* (*Deltocephalus*) *striatus*, L., but not by *Delphacodes* (*Delphax*) *striatellus*, Fall., *Macrosteles* (*Cicadula*) *sexnotatus*, Fall., *Eurygaster integriceps*, Put., *Aelia acuminata*, L., or *Haplothrips tritici*, Kurdj. It was not transmitted by examples of *Laevicephalus* that had not fed on infected plants, even when they were the offspring of infected parents. Nymphs transmitted the disease to winter and spring wheat, oats, barley, rye, *Avena fatua* and *A. byzantina* from winter wheat, and to most of these plants from spring wheat, oats and millet [*Panicum miliaceum*]. In these experiments, the percentages of plants to become infected averaged 50–60 and sometimes reached 100. It appears, therefore, that the same virus causes mosaic in wheat, barley, oats and millet [*cf.* **29** 16].

The incubation period of the virus in the Jassid lasted 5–35 days and averaged 15–16. In winter wheat it varied inversely with temperature and lasted 22, 15 and 9 days at means of 10–15, 15–20 and 20–25°C. [50–59, 59–68 and 68–77°F.]; below 10°C. it was 25–30 days. The virus was transmitted by the nymphs and adults of both sexes, but owing to the protracted incubation period in the insect, nymphs in the first instar were seldom infective. Most infective individuals remained so for a considerable time, and some did so for 60 days. On the other hand, some rapidly lost the power of transmitting the disease, probably owing to the small amount of the virus and its inability to multiply in them. The percentages of nymphs in the first, second and third instars that acquired the virus were 51·4, 17·8 and 6·9, respectively. Nymphs in the fourth and fifth instar and the adults did not acquire it, and their ability to transmit it was evidently due to infection in the earlier instars. The percentages of first-instar nymphs that became infected after feeding on diseased plants for 1, 2 and 5 days were 6·5, 11·7 and 51·4; in no case was 100 per cent. infection obtained. There was no hereditary transmission of the virus through the egg.

It is concluded that, since the older nymphs and adults cannot acquire the virus, diseased plants in the field constitute a danger only when a new generation

of the Jassid appears. In this respect, nymphs of the second generation are of greatest importance, as they transmit the virus to winter wheat, in which it is carried through the winter [*cf.* **29** 618]. Stubble should therefore be ploughed immediately after harvest to destroy the self-sown cereals on which they chiefly develop.

CHATTERJEE (P. N.). **Notes on some Parasites of Shisham Defoliators at Allahabad and Dehra Dun, India.**—*Indian J. Ent.* **3** pt. 2 pp. 157–170, 19 figs., 13 refs. New Delhi, 1941.

Brief notes are given on the biology of parasites bred from the larvae and pupae of Lepidoptera that feed on the leaves of shisham (*Dalbergia sissoo*) in the United Provinces and the Punjab, with descriptions of the immature stages of some of them. In addition to most of the parasites of *Plecoptera reflexa*, Gn., and *Dichomeris eridantis*, Meyr., recorded previously chiefly in the Punjab [*cf. R.A.E.*, A **29** 74] and here also in the United Provinces, they include another species of *Paralitomastix* and *Brachymeria nephantidis*, Gah., from *D. eridantis*, *Bethylus distigma*, Motsch. (*Goniozus montanus*, Kieff. [*cf.* **29** 77]) and an unidentified species of *Apanteles* from *Tortrix* (*Cacoecia*) sp., and a species of *Elasmus* from *Leucoptera sphenographa*, Meyr., all in the United Provinces. More detailed information is given on *Podomyia setosa*, Dol., the eggs of which are laid on the leaves and swallowed by the larvae of *Plecoptera reflexa* during feeding.

CHERIAN (M. C.) & ISRAEL (P.). *Rhaconotus roslinensis* (**Braconidae**), **a larval Parasite of the Sugarcane Borer,** *Scirpophaga rhodoproctalis*.—*Indian J. Ent.* **3** pt. 2 pp. 173–176, 6 refs. New Delhi, 1941.

An account is given of the bionomics of *Rhaconotus roslinensis*, Lal [*cf. R.A.E.*, A **28** 559], of which *R. caulicola*, Mues. [**29** 137] has been found to be a synonym and which is one of the parasites of *Scirpophaga rhodoproctalis*, Hmps. [*cf.* **28** 330] on sugar-cane in Madras. The female of this Braconid begins to oviposit 3–5 days after emerging ; it paralyses the full-grown host larva in its pupal tunnel [*cf.* **28** 329] and oviposits on or near its head. The eggs are laid in clusters of 3–33 at irregular intervals, not on previously parasitised larvae unless no others are available, and only on those within tunnels. The parasite larvae hatch in about 1 day in summer and 2 in winter and attach themselves to the host larvae ; they feed for 3–6 days before spinning their cocoons in the tunnel. The total larval period is 8–10 days, the pupal stage lasts 5–9 days and the complete life-cycle 15–21 ; 7 males and 13 females fed on diluted honey lived for averages of 32 and 21 days, respectively, in the laboratory. The proportion of females to males was about 85 : 15 both in the field and in the laboratory ; 6–25 adults emerged from each parasitised host larva collected in the field. Parthenogenesis results in the production of males only. The parasite is most active in the field between January and March, but becomes scarce as the rains set in and is not noticeable during August–October. It was also reared from larvae of *Chilo zonellus*, Swinh., infesting sorghum.

KRISHNA AYYAR (P. N.). **Host-selection by** *Spathius critolaus* **Nixon, an important Parasite of** *Pempherulus affinis* (**Faust**) **in South India.**—*Indian J. Ent.* **3** pt. 2 pp. 197–213, 1 graph, 16 refs. New Delhi, 1941.

Spathius critolaus, Nixon, is the most important parasite of *Pempherulus affinis*, Faust, on cotton in South India, and since it is the only parasite that attacks the first generation and can be bred rapidly on its other hosts, it might be used for the control of this weevil [*cf. R.A.E.*, A **30** 301]. Lists are given of other natural hosts [*cf.* **29** 522], including the Buprestid, *Sphenoptera araxidis*,

Rttr., on *Sesbania*, and of other food-plants on which *P. affinis* is attacked [*cf. loc. cit.*]. Tests on the nature of the response of the parasite to the sensory impressions produced by such stimuli as the shape, texture, odour, size and movement of the host showed that all these factors operate in combination to render the host suitable for attack and that no single factor can account for the resulting behaviour of the parasite, though size and movement have considerable effect on choice. A series of experiments carried out to determine the factors governing the incidence of superparasitism and the general interactions of host and parasite populations indicated that the parasites normally prefer host larvae in advanced instars and under a covering ; pupae were never attacked and larvae in the early instars and prepupae rarely. The female was able to discriminate between unparasitised and parasitised hosts, attacking relatively few of the latter, even when the parasite eggs had been removed from them. When only parasitised hosts were available, considerable restraint in oviposition occurred ; when unparasitised hosts were included, host larvae containing eggs were occasionally accepted and those with first-instar larvae usually rejected. Superparasitism was not unusual and was influenced by the number and nature of the hosts available, irregularity in the availability of hosts, and the food-plant of the host. Parasitism of hosts on unnatural food-plants occurred in the laboratory, except on a few poisonous ones, unless hosts on natural food-plants were also present, when superparasitism occurred in these. There was no unusual accumulation of eggs in the ovaries of females that had not been able to oviposit. When superparasitism occurred, it was unusual for all the parasites to develop, mortality being due chiefly to competition for food and similar reasons. Hosts parasitised by *S. critolaus* were not attacked by other parasites of *P. affinis*.

GHULAMULLAH. **Aphididae and some other Rhynchota from Afghanistan.**—*Indian J. Ent.* **3** pt. 2 pp. 225–243, 9 refs. New Delhi, 1941.

Records are given of 13 Aphids, of which five are described as new, and 23 other Rhynchota collected on various plants or at light in Afghanistan in 1939. The Aphids include *Hyalopterus arundiniformis*, sp. n., which was common and caused severe curling of the leaves of peach, plum, apricot and bamboo, *Anuraphis* sp. near *A. padi*, L. (*helichrysi*, Kalt.), which also caused severe distortion of the leaves and occurred on peach, almond and iris, *Macrosiphum onobrychis*, Boy. (*pisi*, Kalt.) on berseem [*Trifolium alexandrinum*] and beans, and *Chromaphis juglandicola*, Kalt., and *C.* (*Callipterus*) *juglandis*, Goeze, on walnut. Of the other Rhynchota, *Trigonotylus ruficornis*, Geoffr., was fairly common on rice, and nymphs and adults of *Stephanitis pyri*, F., on apple leaves.

TASKHIR AHMAD & GHULAMULLAH. **Ecological Studies on the Spotted Bollworms of Cotton and their Parasites II. The Fecundity and Longevity of *Earias fabia* and its Parasite, *Microbracon greeni lefroyi* under different Conditions of Temperature and Humidity.**—*Indian J. Ent.* **3** pt. 2 pp. 245–284, 1 graph, 9 refs. New Delhi, 1941.

In this paper, which is part of a series [*cf. R.A.E.*, A **28** 507], the results are given in detail of laboratory investigations on the fecundity, reproductive potential and longevity of *Earias fabia*, Stoll, and its parasite, *Microbracon lefroyi*, D. & G., which the authors consider a race of *M. greeni*, Ashm. [*cf.* **27** 575 ; **29** 264], together with a brief discussion of the incidence of the two species and *E. insulana*, Boisd., which is also a host of the parasite, on cotton at New Delhi in relation to weather conditions. Some of the results, notably those on the effect of temperature, have been noticed from a shorter account [**30** 317].

The following is taken from the authors' summary. It was not possible to control humidity during adult life, but rearing the pre-imaginal stages of both

host and parasite at different saturation deficiencies affected the reproductive capacity of the adults. At the optimum range of temperature, 25–30°C. [77–86°F.], the fecundity of the host is distinctly lowered if it is bred from material under saturated conditions, and that of the parasite is reduced when it is reared from material under rather dry conditions (14 mm. saturation deficiency); the reproductive potential of the parasite is usually greatest when it is bred from material kept at a saturation deficiency of 0–3 mm., indicating that moist conditions are generally more favourable to it than to its host [*cf.* **28** 508].

In order to test the validity of the laboratory conclusions in the field, the incidence of *Earias* spp. and *M. lefroyi* was determined by weekly examination of cotton buds and bolls at New Delhi during 1939 and 1940, and the data collected were plotted on graphs and correlated with temperature and rainfall. In both years it was observed that parasitism began to increase with the first shower of rain, and that, as the rains were well distributed throughout the summer and the temperatures remained moderate, the parasite continued to be active, with the result that the bollworms did not become very injurious. These field observations support the laboratory conclusions that rains in summer help to control the bollworm both indirectly by lowering the temperature, to the benefit of the parasite, and directly by increasing the humidity.

Afzal Husain (M.). **Studies on *Schistocerca gregaria* Forsk. An Account of Locust Visitations in India during the last Cycle (1926–31).**—*Indian J. Ent.* **3** pt. 2 pp. 285–320, 2 appendices (1 fldg.), 6 col. maps, 5 refs. New Delhi, 1941.

This is a month-to-month record of the distribution and breeding of swarms of *Schistocerca gregaria*, Forsk., in India in 1926–31; the areas infested each year are shown on maps.

Short Notes and Exhibits.—*Indian J. Ent.* **3** pt. 2 pp. 335–341. New Delhi, 1941.

Ghulam Ullah (p. 336) records that *Gnorimoschema* (*Phthorimaea*) *operculella*, Zell., which causes damage to stored potato tubers in India, but is seldom injurious in the field there, was breeding locally in large numbers on potato plants in Bombay at the end of September 1941; the leaves were badly mined and etiolated, but the tubers were healthy. T. D. Mukerjee (p. 337) states that the larvae of *Arcyophora dentula*, Led., almost entirely defoliated pomegranates between mid-September and mid-October 1940 at New Delhi. M. Bose (pp. 337–338) gives a brief account of the life-history of *Myllocerus laetivirens*, Mshl., the adults of which feed on the leaves of various plants, including many kinds of fruit trees, in Delhi [*cf. R.A.E.*, A **29** 523]. They feed only at night and appear in large numbers after rain; they are preyed on by a spider and the Mantid, *Empusa pauperata*, F. The female deposits about 40–45 eggs, which hatch in 4–5 days; the larvae feed on the roots of plants and hibernate in the soil near them. Khan A. Rahman (p. 338) records from the Simla Hills that larvae of *Lymantria obfuscata*, Wlk., were found damaging apples at night and hiding in the soil during the day in April–May; they pupated in June. *Malacosoma indica*, Wlk., was collected there on apple, pear, apricot and walnut; the eggs are laid in masses of 300–400 on the branches in May–June and hatch in the following March, and the larval and pupal stages last 39–68 and 8–20 days, respectively. A. N. Sapra (p. 339) reports that a mite of the genus *Eriophyes* seriously damaged fig at Lyallpur by forming galls on the undersides of the leaves, causing them to dry and fall off. It is active throughout the summer and migrates in November to the branches, where it overwinters under the terminal bud-scales.

K. B. Lal and R. N. Singh (pp. 339–340) give an account of observations on the effect of rainfall on the emergence of the adults of *Dorysthenes huegeli*, Redt., which is a serious pest of apple in the Kumaon hills. The life-cycle lasts four years [*cf.* **30** 559], during most of which the larvae develop inside the thick roots. If the spring and early summer are fairly dry the pupae develop normally and the adults emerge after the first rain ; they usually appear in early July but were observed at the end of May in 1941, when the monsoon broke early. If, on the other hand, there is frequent rainfall early in the year, the rate of development of the pupae is presumably slowed down, and emergence is delayed, even though there is normal rainfall in July. Though both sexes are positively phototropic, males are taken more frequently at light.

DA COSTA LIMA (A.). **Sôbre um** *Pantomorus* **pouco conhecido (Coleoptera : Curculionidae-Brachyderinae).** [On a little known *Pantomorus*.]—*An. Acad. bras. Cienc.* **13** no. 4 pp. 301–303, 1 fig., 1 ref. Rio de Janeiro, 1941.

A weevil of which adults of both sexes were found attacking *Citrus* in the State of Ceará, Brazil, has been identified as *Pantomorus* (*Brachyderes*) *glaucus*, Perty.

DA COSTA LIMA (A.). **Sôbre um microimenoptero parasito da lagarta broca da couve.** [On a Hymenopterous Parasite of the Cabbage Caterpillar.]—*Chacaras e Quint.* **57** pp. 785–786, 2 figs. São Paulo, 1938. [Recd. 1942.]

Descriptions are given of the adults of both sexes of *Microbracon hellulae*, sp. n., which was bred from larvae of the Pyralid, *Hellula phidilealis*, Wlk., mining in the stalks of cabbage in the State of Rio de Janeiro, Brazil. This Braconid is ectophagous and pupates in a silken cocoon in the mine of the host.

DA COSTA LIMA (A.). *Gasterocercodes* **Pierce, sinonimo de** *Eutinobothrus* **Faust.**—*Chacaras e Quint.* **58** no. 4 p. 471. São Paulo, 1938. [Recd. 1942.]

A weevil boring in *Sida* sp. in Minas Gerais, Brazil, has been identified as a species of *Eutinobothrus*, probably *puncticollis*, Hust. As a result of the examination of specimens, the author considers that *Gasterocercodes*, Pierce, of which the species are *gossypii*, Pierce [*R.A.E.*, A **3** 273] and *brasiliensis*, Hambleton [**26** 115], is congeneric with *Eutinobothrus*.

DA COSTA LIMA (A.). **Sôbre a " joaninha "** *Coccidophilus citricola* **Brèthes, 1905 (Coleoptera, Coccinellidae).** [On the Ladybird, *C. citricola*.]—*Rev. brasil. Biol.* **1** no. 4 pp. 409–414, 5 figs., 16 refs. Rio de Janeiro, 1941.

The author reviews the records of *Coccidophilus citricola*, Brèthes, from South America and discusses its classification, concluding that it is a Coccinellid of the tribe Pentiliini. It has been observed to be predacious on *Lepidosaphes* (*Mytilococcus*) *beckii*, Newm., *Aulacaspis pentagona*, Targ., *Chrysomphalus ficus*, Ashm. (*aonidum*, auct.) and *Protargionia larreae*, Leon., in Argentina, *Aspidiotus* spp. in Chile, and *L. beckii*, *Aulacaspis pentagona* and *Aonidiella aurantii*, Mask., in Brazil.

WADDELL (D. B.) & MARSHALL (J.). **The Calyx Spray in Codling Moth Control.**—*Sci. Agric.* **22** no. 7 pp. 413–418, 8 refs. Ottawa, 1942.

The omission of a calyx spray from the programmes used in commercial orchards against *Cydia* (*Carpocapsa*) *pomonella*, L., on apple in British Columbia has not resulted in increased infestation of the fruit in every season, but in field experiments in 1932–40, infestation was slightly though consistently greater on

trees that did not receive a calyx application than on those that did [*cf. R.A.E.*, A **21** 541]. In experiments in 1939–40, apple trees about 20 years old were sprayed when 90 per cent. of the petals had fallen with $3\frac{3}{4}$ lb. lead arsenate and 3·3 oz. calcium-caseinate spreader in 100 gals. water. Samples of the fruit were removed to the laboratory at various intervals, beginning about one month after spraying, and individual newly hatched larvae were placed on the sepals and enclosed with glass vials. The fruits were dissected 8–10 days later, and larval activities recorded. A single nozzle spray-gun operated from the ground alone deposited as much spray on the calyx parts as an angle nozzle on a bamboo rod used from both the ground and the top of the spray-tank, and the operation required only one-third as much time. The larvae chewed very little on the inner parts of the calyx but did so freely on the sepals.

The percentages of larvae that died on the sprayed fruits one and three months after the spray had been applied were 87 and 72 as compared with 28 and 15 on controls. Of the total number of larvae on sprayed fruits, 83 per cent. died, 3 per cent. entered through the calyx and 14 per cent. at the outer base of the sepals, as compared with 28, 28 and 44 per cent. of those on control fruits. It was thus evident that the calyx application deposits poison on the outer surfaces and outer bases of the sepals as well as the inner surfaces, and retains its effectiveness for several months. It is concluded that the application of a calyx spray in British Columbia is a sound practice, but that it is not essential to force the spray into the inner calyx cavity.

PUTMAN (W. L.). **Notes on the predaceous Thrips *Haplothrips subtilissimus* Hal. and *Aeolothrips melaleucus* Hal.**—*Canad. Ent.* **74** no. 3 pp. 37–43, 1 fig., 11 refs. Guelph, Ont., 1942.

The following is substantially the author's summary. The predacious thrips, *Haplothrips subtilissimus*, Hal., was found generally distributed but seldom abundant in peach orchards in the Niagara Peninsula of Ontario, occurring in greatest numbers on trees infested by *Paratetranychus pilosus*, C. & F. Eggs of this mite and of *Tetranychus telarius*, L., were attacked, as well as those of *Cydia* (*Grapholitha*) *molesta*, Busck, and other insects. Data on various phases of the life-history were obtained. There were four generations a year, only one or two of which were complete, and the adults hibernated. Reproduction was thelytokous, males not being found during the study. The species was of minor importance as a predator. Another predacious species, *Aeolothrips melaleucus*, Hal., was occasionally found attacking all stages of both mites in peach orchards.

FREEMAN (T. N.). **A new *Argyrotaenia* from Spruce (Lepidoptera, Tortricidae).**—*Canad. Ent.* **74** no. 4 p. 57. Guelph, Ont., 1942.

A description is given of the adults of *Eulia* (*Argyrotaenia*) *occultana*, sp. n., from Nova Scotia, Quebec, Ontario and Alberta. The larva is destructive to spruce foliage.

BROWN (A. W. A.) & MCGUFFIN (W. C.). **New Descriptions of Larvae of Forest Insects. II, *Anomogyna* (Lepidoptera, Phalaenidae).**—*Canad. Ent.* **74** no. 2 pp. 21–25, 2 pls., 4 figs. Guelph, Ont., 1942. **III, *Zanclognatha, Palthis*, and *Autographa* (Lepidoptera, Phalaenidae).**—*T. c.* no. 3 pp. 52–56, 1 pl., 4 figs. **IV, *Herculia, Tortrix*, and *Argyrotaenia* (Lepidoptera, Pyralidae and Tortricidae).**—*T.c.* no. 4 pp. 58–61, 1 pl., 5 figs.

In these parts of a series of descriptions of the larvae of Canadian forest insects [*cf. R.A.E.*, A **30** 504], the species dealt with are *Anomogyna elimata*, Gn., *A. perquiritata*, Morrison, *Epizeuxis* (*Zanclognatha*) *minoralis*, Smith, *Palthis angulalis*, Hb., *Autographa selecta*, Wlk., from which *A. alias*, Ottolengui,

and *A. rectangula*, Kby., are at present indistinguishable in the larval stage, *Herculia thymetusalis*, Wlk., *Tortrix packardiana*, Fern., and *Eulia* (*Argyrotaenia*) *occultana*, Frmn. [*cf.* preceding abstract]. Lists of the food-plants of each species are given ; they all attack spruce and some of them other conifers as well, while *Palthis angulalis* has also been recorded from deciduous trees.

Gorham (R. P.). **Rearing the Aphid,** *Myzus persicae* **Sulzer, indoors in Winter.** —*Canad. Ent.* **74** no. 4 p. 76. Guelph, Ont., 1942.

Since *Myzus persicae*, Sulz., is frequently present on the leaves of swedes in New Brunswick at harvest and continues to multiply on the sprouts formed on the swedes when they are placed in a warm cellar, rearing of Aphids for experimental purposes was attempted on swedes in the laboratory. With six swedes in pots, it was possible to maintain a daily production of 50 winged Aphids from November to March, and with 20 in a box of sand, a daily production of 1,000 winged Aphids for spray tests was maintained without difficulty. The plants were changed when the sprouts and leaves became wilted owing to the feeding of the Aphid. A temperature of 76°F. and a relative humidity of 35 per cent. were found to be the most favourable ; the plants were kept uncovered on a table, and the Aphids collected on a window nearby, from which they were taken as needed.

Haddow (W. R.) & Newman (F. S.). **A Disease of the Scots Pine** (*Pinus sylvestris* **L.) caused by the Fungus** *Diplodia pinea* **Kickx, associated with the Pine Spittle-bug** (*Aphrophora parallela* **Say.). I. Symptoms and Etiology.**— *Trans. R. Canad. Inst.* **24** pt. 1 pre-print 17 pp., 1 pl., 5 figs., 32 refs. Toronto, 1942.

During the last 25 years, plantations of Scots pine (*Pinus sylvestris*) have been extensively established in southern Ontario for reforestation and other purposes, but many deteriorate in their second decade or later, and sometimes suffer severe mortality. In the last few years several instances of destructive epidemic disease of *P. sylvestris* have been investigated, and a common cause was discovered in the association on the tree of the fungus, *Diplodia pinea*, and the Cercopid, *Aphrophora parallela*, Say. The literature on the occurrence of the fungus is reviewed, its identity is discussed and descriptions of its pycnidia and spores are given. Three types of symptoms due to infection by the fungus in southern Ontario are described ; they comprise a twig and tip blight of various conifers in plantations and the natural forest, which is usually rare, a tip blight of young Scots pine stock, which is not of a serious character, and a lethal, epidemic bark disease of twigs, branches and stems of Scots pines, particularly trees over 15 years old, with massive crown infection and close spread, which often causes the death of whole trees. It is this epidemic disease that is dependent on an association with *A. parallela*, which, when it becomes abundant, renders the trees liable to mass infection. Observations on the bionomics of the Cercopid [*cf. R.A.E.*, A **21** 74 ; **28** 418] showed that the nymphs, enveloped in froth, appear just below the expanding buds about the middle of May ; as the masses of froth enlarge and coalesce the nymphs become aggregated. The last moult occurs on the tips of the needles. The nymphs feed chiefly on the shoots on which they hatch, and the adults feed on the younger internodes, including those of the current year, which, however, seem to be less attractive than older growth. An estimate made to determine the number of Cercopids present under conditions of heavy infestation showed that a 24 ft. tree bore 1,500 frothy clusters and 2,000 nymphs in early June. On 6th July, when the froth had disappeared, 41 adults were counted on a 10 ft. tree, 29 being on internodes of the last four years. In addition, 15 dead adults were found attached to the bark by their stylets. Penetration by the stylets is often

deep, and adults feeding on young internodes may reach the cambium, inducing traumatic false rings that resemble frost rings, but occur in the late wood. The Cercopids thrive on vigorous, healthy trees, and rarely survive on suppressed, slow-growing ones.

Mortality of *P. sylvestris* has often been attributed to infestation by *A. parallela*, but isolated trees and whole plantations have been observed to suffer heavy infestation repeatedly without apparent gross injury. Often withering of foliage and twigs, characterised by pale colour, has been observed in infested trees and the subsequent killing of shoots by a species of *Pityophthorus* is common, but the worst effects observed have followed the invasion of infested trees by *Diplodia pinea*.

In experiments on infection with the fungus, a concentrated suspension of spores was applied in June 1939 to clusters of stylet wounds on a branch of a Scots pine heavily infested by *A. parallela* but not suffering from the disease. In October, a few short shoots had died, and by the following summer many needles were dead. By September 1940, the branch was badly deformed and almost girdled by cankers.

Minutes of the 524th regular Meeting of the Entomological Society of Washington.—*Proc. ent. Soc. Wash.* **44** no. 3 pp. 55–56. Washington, D.C., 1942.

At the meeting held in January 1942, a note by L. A. Hetrick was communicated on an undescribed sawfly of the genus *Xyela* that he had reared from galls on young shoots of *Pinus taeda* (loblolly pine) at West Point, Virginia. The infested shoots usually die, producing an effect like that caused by *Rhyacionia frustrana*, Comst. The larvae were placed in jars with soil in an outdoor insectary in May 1940 and the adults emerged on 31st December 1941. The full-grown larvae leave the galls and enter the soil. The pupae are capable of movement and possess heavily sclerotised functional mandibles ; by this means they make their way to the surface of the soil where transformation to the adult occurs. *Eurytoma tylodermatis*, Ashm., and *Habrocytus thyridopterigis*, Ashm., both of which also parasitise the larvae of *R. frustrana*, were reared from *Xyela* galls.

Ewing (H. E.) & Nesbitt (H. H. S.). **Some Notes on the Taxonomy of Grain Mites (Acarina : Acaridae, formerly Tyroglyphidae).**—*Proc. biol. Soc. Wash.* **55** pp. 121–124. Washington, D.C., 1942.

The authors consider that the [undescribed] varieties *scabiei*, L., and *farinae*, L., of *Acarus siro*, L., provide available names for the scabies mite and the flour mite [*Sarcoptes scabiei*, DeG., and *Tyroglyphus farinae*, DeG.], that *farinae* must be considered a synonym of *siro*, that the latter is the type of *Acarus* and of *Tyroglyphus*, and consequently that *Tyroglyphus* is a synonym of *Acarus*.

In a note on the identity of the bulb mite described by Banks as *Rhizoglyphus hyacinthi*, they point out that Banks supposed that he was re-describing *Acarus hyacinthi*, Boisd. They agree with Oudemans, however, that the latter is referable to the Tarsonemid genus *Siteroptes*, and regard Banks' species as identical with *R. echinopus*, Fum. & Rob.

Characters are given distinguishing *Tyrophagus lintneri*, Osb., obtained from mushrooms in the eastern United States and an unnamed species of the same genus received from mushrooms in England.

Ditman (L. P.), Secrest (J. P.) & Cory (E. N.). **Studies on Corn Ear Worm Control.**—*Bull. Md agric. Exp. Sta.* no. 439 pp. 205–223, 2 figs., 11 refs. College Park, Md., 1941.

An account is given of recent work in Maryland on the bionomics and control of *Heliothis armigera*, Hb., on sweet maize. Infestation by it increased in 1937–39, but was relatively light in 1940, probably because of the severity of the

preceding winter. In 1939, serious damage was caused to snap and lima beans. Infestation of tomatos occurs, but is not normally severe. Work on dormancy and hibernation has already been noticed [*cf. R.A.E.*, A **29** 123].

Both the removal of the silks [*cf.* **28** 520] and the use of mineral oil containing 3 per cent. dichloroethyl ether [*cf.* **30** 267] appear to be practical methods of controlling *H. armigera* on sweet maize for the market. Removing the silk at weekly intervals is a safe and fairly effective practice when infestations do not exceed 80 per cent. Where infestations approach 100 per cent. and when late-season infestations of *Laphygma frugiperda*, S. & A., occur, neither method protects maize from injury. The addition of 0·1 per cent. pyrethrins to mineral oil increases its effectiveness [*cf.* **28** 184], but not sufficiently to justify the increased cost of treatment. Derris extract and nicotine did not increase the effectiveness of oil.

Some reduction in moth population is effected by poison baits of cane sugar [*cf.* **25** 427], but it is not sufficient to afford control. In olfactometer and field tests, none of 18 materials caused any consistent feeding response or showed any attractiveness. When sugar baits were exposed on pieces of coloured cloth, more moths were attracted to yellow than to any other colour.

HUBER (L. L.) & STRINGFIELD (G. H.). **Aphid Infestation of Strains of Corn as an Index of their Susceptibility to Corn Borer Attack.**—*J. agric. Res.* **64** no. 5 pp. 283–291, 2 figs., 5 refs. Washington, D.C., 1942.

Details are given of experiments in Ohio indicating that inbred lines of maize and their hybrids exhibit heritable differences in susceptibility to *Aphis maidis*, Fitch, and that susceptibility to the Aphid is measurably correlated with susceptibility to *Pyrausta nubilalis*, Hb. A brief account of some of the work and of its practical application has already been noticed [*R.A.E.*, A **29** 529].

MURPHEY jr. (M.). **Household Insects.**—*Bull. Ga Dep. Ent.* no. 81, 39 pp., 11 figs., 9 refs. Atlanta, Ga., 1940. [Recd. 1942.]

A brief account is given of the life-history and control of mites and insects that are troublesome in houses in Georgia, where the mild climate makes it possible for many of them to breed in the open, and they are consequently plentiful. The insects dealt with are silverfish, cockroaches, camel-crickets, termites, booklice, bed-bugs, clothes moths, carpet beetles, powder-post beetles, ants, fleas, mosquitos and the house-fly.

ANNAND (P. N.). **Report of the Chief of the Bureau of Entomology and Plant Quarantine, 19**[40–]**41.**—120 pp. Washington, D.C., U.S. Dep. Agric., 1942.

An account is given of work on insect pests and their control in the United States during the year ending June 1941, some of which has already been noticed.

Indications in laboratory tests in the previous year of the superiority of very finely divided phenothiazine [thiodiphenylamine] over the standard material used in most experimental work for the control of the codling moth [*Cydia pomonella*, L.] on apple were confirmed in the field; the irregular results obtained in early experiments with this substance are thought to have been due to variations in particle size. Xanthone showed marked promise in sprays against *C. pomonella* in the north-western States [*R.A.E.*, A **29** 411, 640], but has not given consistent results in the Middle West and eastern States. *Pseudococcus comstocki*, Kuw., has three complete generations a year on apple in Virginia, but the third is only partial in West Virginia. Of three Japanese parasites that were liberated against it in 1940 [**29** 425], two appear to have

survived the winter; the most promising is a gregarious species of *Allotropa*, which was recovered from seven of eleven orchards in which it was released during the year and increased rapidly in most of them. In recent years, mass liberations of parasites of the oriental fruit moth [*C. molesta*, Busck] on peach have been made to provide control in the same season, in contrast to smaller liberations for purposes of colonisation. The average infestation in orchards in which parasites have been liberated has been considerably lower than in those in which they have not, and the reduction appeared to be due to them. Excellent results were obtained by rearing *Macrocentrus ancylivorus*, Rohw., on first-generation larvae of the strawberry leaf-roller [*Ancylis comptana*, Froel.] in field cages over strawberry beds for release early in the season against *C. molesta*. Dichloroethyl ether applied to the soil in early summer was found to be effective against larvae and pupae of the plum curculio [*Conotrachelus nenuphar*, Hbst.] in laboratory tests and small-scale trials in peach orchards. The best control of the grape-berry moth [*Polychrosis viteana*, Clem.] in experiments on vines in Ohio was given by two applications of a spray of calcium arsenate against the first-generation larvae, followed by three of a processed nicotine bentonite against the second. Almost as good results were given by two applications against each generation of tank-mixed nicotine bentonite, but it left heavy residues and was less effective than calcium or lead arsenate against the first generation [*cf.* **29** 425]. Phenothiazine was fairly effective against the second generation, left no residue and did not injure the foliage. A commercial nicotine bentonite (14 per cent. nicotine) applied throughout the season gave fair control, but was rather costly.

Experiments in Georgia showed that much of the emergence of adults of the hickory shuckworm [*Enarmonia caryana*, Fitch] and increase in populations on pecan during July and August, when the larvae are most injurious, can be prevented by burying fallen infested nuts to a depth of 2 ins. or more during that period, preferably with equipment of the disk-tiller type; this reduced infestation in two pecan orchards by 50–65 per cent. In California, some protection from the saw-toothed grain beetle [*Oryzaephilus surinamensis*, L.], the adults of which seldom fly, was afforded to raisins stacked in boxes by surrounding them with oil-filled trough barriers. In further work on the use of cubé resins in oil against the California red scale [*Aonidiella aurantii*, Mask.] on *Citrus* [**29** 426], an increasing proportion of the total spray mixture deposited on the wood became insecticidally active as the deposits increased; the mortality immediately after application was greater when the resins were added to light medium oils than when they were added to heavy ones.

The felling of susceptible trees in stands of mature ponderosa pine [*Pinus ponderosa*] in north-eastern California and south-eastern Oregon as a preventive measure against attack by the western pine beetle [*Dendroctonus brevicomis*, Lec.] has for several years proved both profitable and effective. A survey of *P. ponderosa* and Jeffrey pine [*P. jeffreyi*] in California showed that about 11,500 million board feet of timber had been destroyed by *D. brevicomis* in the course of 15 years and that much of the remaining stand was in a susceptible condition and likely to be destroyed within a few years if weather and other factors influencing the vigour of the trees were unfavourable. It was found that bark-beetles responsible for the dissemination of the fungus causing Dutch elm disease [*Ceratostomella ulmi*] can be destroyed by means of trap trees into which sodium chlorate with the addition of a small quantity of sodium arsenite is injected. The sodium chlorate makes the trees attractive to the adults, and the young larvae to which they give rise are killed by the arsenite. Excellent control of the white pine weevil [*Pissodes strobi*, Peck], which is the most serious pest of eastern white pine [*Pinus strobus*] and attacks it and Norway spruce [*Picea abies*] wherever they are grown in the north-eastern States, can be obtained by spraying the main shoots in autumn or before oviposition begins in the spring with 14 oz. lead arsenate and 3½ oz. fish-oil in 1 U.S. gal. water, at the

rate of about 4 U.S. gals. per acre, by means of a knapsack sprayer with an extension rod having a special nozzle that produces a fine, narrow, cone-shaped spray.

Several strains of maize that were resistant to both the corn earworm [*Heliothis armigera*, Hb.] and the chinch bug [*Blissus leucopterus*, Say] were raised. Larvae of *H. armigera* can hibernate successfully in dry mild winters in districts considerably farther north than in wet cold ones ; sandy, well-drained soils are the most favourable for hibernation. Owing to a season favourable to it, the European corn borer [*Pyrausta nubilalis*, Hb.] caused a loss of maize estimated at 6½ million dollars in 1940 as compared with 4 million in 1939. Poison baits distributed from aircraft against grasshoppers were found to lose about 60 per cent. of their water content while falling through the air. Excellent distribution of baits of dry bran and oil was given by power dusting equipment, and in dry land areas, baits of low water content distributed from aircraft compared favourably in effectiveness and cost of application with standard bait applied by mechanical spreaders from the ground. Studies on the bionomics of the Mormon cricket [*Anabrus simplex*, Hald.] showed that development is possible at soil temperatures of 60–90°F., the most favourable conditions being a constant temperature of 75°F. and a soil moisture content of 50 per cent. Development was found to last two years at high altitudes in Wyoming [**30** 171]. Satisfactory results were given by a poisoned bait in which 1 gal. cheap lubricating oil was substituted for 15 gals. water, which is scarce in many areas infested by *A. simplex* ; this bait and one containing water gave excellent control when distributed from aircraft over an area of 7,000 acres of dry land in Nevada.

In studies in southern Wisconsin, the preferred food-plants of white grubs [*Lachnosterna* spp.], determined by the extent of oviposition on each, were found to be, in descending order, bluegrass [*Poa*], red clover, timothy grass [*Phleum pratense*], lucerne, oats, Sudan grass [*Sorghum sudanense*], sweet clover [*Melilotus*], maize and soy bean. Leguminous plants appeared to be unsuitable for larval development, probably owing to the low moisture content in the soil in which they grow.

The mixture of ethylene dichloride and carbon tetrachloride recommended for the fumigation of stored grain [**29** 429] did not affect the germination of seed grain treated with it, even when used at concentrations higher than those normally recommended. The possibility of destroying insects by heating the grain stream as it enters the mill was demonstrated in experiments ; grain passed successively through metal cylinders heated to 212–400°F. for 10–40 seconds became hot enough to destroy all insects without injury to the grain or to flour milled from it. Milled cereals at 68°F. that were passed through commercial grain sterilisers utilising steam pressures of 70–100 lb. per square inch were discharged after 5–10 minutes at a temperature of 160°F., which is fatal to insects. It appeared possible to protect milled cereals from infestation by insects present in railway waggons in which they are transported by lining the waggons with thin tough paper impregnated with a solution of nicotine sulphate.

In experiments in Maine, a spray applied against the green peach Aphid [*Myzus persicae*, Sulz.], the buckthorn Aphid [*Aphis rhamni*, Boy.] and the potato Aphid [*Macrosiphum solanifolii*, Ashm.] on potato resulted in increased yields of tubers, but did not reduce leaf-roll disease [*Corium solani* of Holmes], which is transmitted by the Aphids. The percentage of infected plants was highest in plots in which the Aphids were most successfully controlled, probably because the growing period of sprayed plants was prolonged by about a fortnight, so that there was a longer period for transmission. In two large-scale experiments on the control of wireworms, crude naphthalene applied at the rate of 800 lb. per acre to each side of the furrows as they were turned and incorporated into the soil by disking gave 70–80 per cent. mortality in sandy loam soils, but less than 15 per cent. in silt loams. Sprays and dusts containing

sulphur or combinations of sulphur and lime gave marked control of young nymphs (in the first four instars) of the beet leafhopper [*Eutettix tenellus*, Baker] on sugar-beet, the result being due to both direct and residual action, which in the case of sprays of lime-sulphur continues for about three weeks. Lime-sulphur was not rendered more effective by the addition of arsenicals. Laboratory and field tests indicated that a combined spray containing lime-sulphur and pyrethrum retains its effectiveness for a longer period than a spray of pyrethrum in oil and can be used on young plants. In south-central Idaho, the loss due to *E. tenellus*, even on varieties resistant to curly-top [*Chlorogenus eutetticola* of Holmes] is approximately 2 tons sugar-beet per acre. The number of seed plants infected with curly-top in May 1941 was reduced by 45 per cent. in plots treated in October 1940 with an atomised spray containing pyrethrum in oil, and the severity of the disease was less on treated plants than on untreated controls. The only bugs that severely affect the production of seed by sugar-beet are *Lygus oblineatus*, Say, and *L. hesperus*, Knight ; *L. elisus*, Van D., is of slight importance. Tests in Arizona and New Mexico indicated that the first two of these Capsids can be reduced and seed production increased by the use of dusting sulphur or mixtures containing a derris dust or a dust impregnated with pyrethrum extract. Sprays containing a water-soluble pyrethrum extract or an extract of pyrethrum in oil emulsified in water were less effective.

In experiments against hornworms [*Protoparce*] on tobacco in South Carolina, sprays of 2 lb. lead arsenate in 50 U.S. gals. water were markedly superior to those of 6 lb. cryolite in 50 U.S. gals., but damage was slight in all the treated fields, and with the addition of an adhesive, cryolite sprays would probably be effective. Excessive quantities of lead arsenate can be avoided by the use of sprays, since only about 3 lb. was used per acre in each application. Large-scale experiments indicated that gas-curtains enable open-storage warehouses to be successfully fumigated for the control of the cigarette beetle [*Lasioderma serricorne*, F.] and the tobacco moth [*Ephestia elutella*, Hb.] in stored tobacco by using 12 oz. liquid hydrocyanic acid per 1,000 cu. ft. air space. The gas-proof curtain is used to seal the walls of the warehouse where openings are provided for ventilation ; it is suspended from the top, weighted at the bottom and sealed along the top edge with material of a temporary nature.

The value of a dust of 7·5 per cent. Paris green and 92·5 per cent. dusting sulphur applied by aircraft at the rate of 15 lb. per acre against Rhynchota on cotton was tested in Arizona in 1939 and 1940. In 1939, 7 applications were made at weekly intervals irrespective of the intensity of infestation ; but in 1940 the plants were treated only when 12 or more Capsids (including *Lygus* spp.) or other Rhynchota were taken in 100 sweeps of a net or six or more Pentatomids (including *Chlorochroa* and *Euschistus*) were taken from 100 plants, and 2–7 applications were made between 10th July and 22nd August. The improvement in quality resulting from the treatment was more marked in long-staple than in short-staple cotton, but the gain in weight of seed cotton averaged 569 lb. per acre for the latter and 208 lb. for the former. The increase in quality and weight were both more marked in 1940 than in 1939.

Several insecticides were tested for the control of the bollworm [*Heliothis armigera*] on cotton, since calcium arsenate is slow in action and not very effective against the older larvae. The percentage mortalities among laboratory-reared larvae varied inversely with their size but averaged 92 for a mixture of equal quantities of basic copper arsenate and lime, 88 for lead arsenate, 84 for undiluted basic copper arsenate, 83 for cryolite containing 66 per cent. sodium fluoaluminate, and 62 for calcium arsenate. In field tests in Texas, the yield of seed cotton from plants that had been treated with cryolite containing 50, 66, 87 and 95 per cent. sodium fluoaluminate at the rate of 16–20 lb. per acre was increased by 51, 124, 163 and 179 lb. per acre, respectively, the corresponding increases for plots dusted with calcium arsenate, basic copper arsenate and lead arsenate at the rate of 8–10 lb. per acre being 144, 155 and 208 lb. When

calcium arsenate, lead arsenate and micronised barium fluosilicate were applied as dusts and sprays, the increase in yield in plots treated with dusts averaged about 33·3 per cent. more than in those treated with sprays. Field observations have shown that heavy oviposition by *H. armigera* is not invariably followed by severe larval infestation and that the larvae are often most injurious in fields in which Aphids are common. In addition to hot, dry weather, which prevents hatching, the eggs and young larvae are destroyed by predators, including Coccinellids, Chrysopids, Syrphids and *Orius insidiosus*, Say. In the laboratory, this Anthocorid consumed many eggs daily when other food was scarce, but very few when Aphids were present. A dust containing calcium arsenate and enough nicotine to destroy the Aphids had little effect on *O. insidiosus*, and its use might increase the effectiveness of this predator in the field.

Introduced parasites reared and released in considerable numbers against the pink bollworm [*Platyedra gossypiella*, Saund.] in Texas comprised *Chelonus pectinophorae*, Cushm., which was imported from Japan during the year, *C. blackburni*, Cam., *Microbracon nigrorufum*, Cushm., and *M. kirkpatricki*, Wlkn. In the Lower Rio Grande Valley, *P. gossypiella* continued to breed from May 1940 until severe weather in January 1941 destroyed the squares and bolls. The maximum durations of the larval diapause were from 25th September until 11th June in open bolls on standing stalks, from 26th September to 21st April in open bolls on the soil surface, from 28th October until 20th May in bolls collected green and left on the soil surface, and from 28th October until 17th March in bolls collected green and lightly covered with soil. The maximum survival rate occurred in bolls on standing stalks, so that it is desirable to cut the stalks or plough them under in autumn, even if the bolls cannot be destroyed. No larvae were found to overwinter in free cocoons in the soil in this area.

Attempts to eradicate an infestation of *Tarsonemus bancrofti*, Michael, on sugar-cane in Florida in the spring of 1941 appeared to be successful. *Triaspis thoracicus*, Curt., was reared throughout the season in 1941 for release against the vetch Bruchid [*Bruchus brachialis*, Fhs.] in North Carolina and Oregon; work on this Braconid was then discontinued, as it has been liberated in each year since 1935 against the pea Bruchid [*Bruchus pisorum*, L.] and since 1937 against *B. brachialis*. The most important alternate hosts of *Angitia* (*Inareolata*) *molestae*, Uch., in Japan, where it is the most effective parasite of *Cydia molesta*, were found to be *Anacampsis metagramma*, Meyr., on peach and other fruit trees, and two species of *Argyroploce* (*Olethreutes*) that infest willow and *Elaeagnus* sp., respectively. Parasites imported into the United States during the year included four species of *Allotropa*, *Leptomastix* sp., *Pseudaphycus* sp. and *Anagyrus* sp. from Japan against *Pseudococcus comstocki*; *Lydinolydella metallica*, Tns., from Brazil against the Mexican bean beetle [*Epilachna varivestis*, Muls.]; and *Ephialtes* (*Calliephialtes*) *dimorphus*, Cushm., also from Brazil against *Platyedra gossypiella*. Parasites and predators shipped to other countries comprised *Prospaltella berlesei*, How., for liberation against the white peach scale [*Aulacaspis pentagona*, Targ.] in Cuba; and *Rodolia cardinalis*, Muls., against the cottony cushion scale [*Icerya purchasi*, Mask.] and *Aphelinus mali*, Hald., against the woolly apple Aphid [*Eriosoma lanigerum*, Hsm.] in Ecuador and Venezuela.

Investigations showed that the concentration of hydrocyanic acid gas under field tents during fumigation of *Citrus* was uniform at all levels, so that the habit of certain predators of dropping to the ground when fumigation begins does not increase their rate of survival. Populations of the parasite, *Comperiella* [*bifasciata*, How.], on *Citrus* were reduced by 90 per cent. within 24 hours of the application of sulphur dust, and deposits of tartar emetic remained toxic to adult parasites for as long as two weeks. It was found that, unlike other parasites, *C. bifasciata* is most effective in controlling the yellow scale [*Aonidiella citrina*, Coq.] when the host populations are low, and is therefore useful in

maintaining them at a low level after they have been reduced by other methods. Mealybugs cannot be controlled satisfactorily by *Cryptolaemus* [*montrouzieri*, Muls.] on *Citrus* dusted with cryolite, which causes high mortality of this predator. Chemical investigations on insecticides are briefly reviewed.

Summary for 1941.—*Insect Pest Surv. Bull.* **21** no. 10 pp. 795–816, 3 maps, multigraph. [Washington, D.C.] U. S. Dep. Agric. Bur. Ent. [1942.]

The insect pests that occurred in the United States during 1941 are discussed as in previous years [*cf. R.A.E.*, A **30** 171]. In general, the weather was warmer and rainfall greater than usual, and insects overwintered in the usual abundance, though their numbers were later reduced by heavy spring and summer rains, and, in the eastern States, by severe droughts during summer. Abnormally warm weather in autumn enabled large populations to be built up again. The probable distribution and intensity of infestation by grasshoppers and the Mormon cricket [*Anabrus simplex*, Hald.] in 1942, and the areas generally infested by the Japanese beetle [*Popillia japonica*, Newm.] at intervals between 1925 and 1941 are shown on maps.

The European corn borer [*Pyrausta nubilalis*, Hb.] occurred to the west and south-west of the previously infested area in Wisconsin, Illinois and Indiana and to the south-east in Pennsylvania, Virginia, Maryland and North Carolina. It was also recorded for the first time from Washington, D.C. In both Wisconsin and Illinois, infestation now extends over about half the State. In the Fellsmere area of Florida, the sugar-cane borer [*Diatraea saccharalis*, F.] was less abundant than usual, partly owing to the influence of the introduced parasites, *Lixophaga diatraeae*, Tns., and *Microdus* (*Bassus*) *stigmaterus*, Cress., which attacked 68 per cent. of the larvae. Mortality among hibernating adults of the plum curculio [*Conotrachelus nenuphar*, Hbst.] in Georgia was unusually low, and owing to the early seasonal development of the weevil, mid-season, as well as late, varieties of peach were heavily infested by second-generation larvae. Late varieties of peach and plum were severely damaged in Mississippi, and plum was also infested in Ohio. In April, large numbers of adults of the vegetable weevil [*Listroderes obliquus*, Gylh.] attacked the outer rows of newly-planted shade-grown tobacco in Florida; this is the first record of injury to tobacco by the adults.

Rhopalosiphum (*Aphis*) *abietinum*, Wlk., severely damaged Sitka spruce [*Picea sitchensis*] in coastal districts of Washington and Oregon for the first time for several years. Many intermediate and suppressed trees were defoliated and killed, but in most of the larger trees only the lower part of the crown was defoliated. In general, loss to timber in California from attack by bark-beetles declined appreciably during the year, chiefly owing to reductions in populations of *Dendroctonus brevicomis*, Lec., on ponderosa pine [*Pinus ponderosa*] and *D. monticolae*, Hopk., on sugar pine [*P. lambertiana*]. These reductions are attributed to the improved growth of the trees resulting from higher rainfall and to the shortening of the period during which the beetles were active by the late cold spring and summer. *D. brevicomis* failed to complete its usual number of generations; and at high altitudes, where they normally complete one seasonal generation, adults of *D. monticolae* and the Jeffrey pine beetle [*D. jeffreyi*, Hopk.] failed to emerge during summer and autumn. Infestation of Jeffrey pine [*P. jeffreyi*] by *D. jeffreyi* was so high, however, that there was no marked decrease in timber losses due to it. *Gilpinia frutetorum*, F., was found to be well established in many of the older plantations of red and Scots pine [*P. resinosa* and *P. sylvestris*] in New York State and the southern half of New England. Adults emerged between 1st July and 1st September from about 47 per cent. of the cocoons, and about 17·5 per cent. of the larvae remained in diapause for a second winter.

Amos (J. M.) & Beacher (J. H.). **Dusting for Control of Strawberry Weevil in 1941.**—*Trans. Peninsula hort. Soc. 1941* pp. 23–25. [Dover, Del.] 1942.

In 1941, adults of *Anthonomus signatus*, Say, were observed on strawberry in Delaware on 15th April and were abundant and ovipositing by 29th April. Dusts applied with a hand duster on 21st and 26th April and 3rd May on a farm where 31 per cent. of the untreated buds were damaged and on 19th and 25th April at one where 54 per cent. were injured gave similar results : cryolite, barium fluosilicate or calcium arsenate, when diluted with Celite 209 [a silica dust] and clay (3 : 3 : 2) increased the proportion of uninjured buds by 61, 59 and 58 per cent., the corresponding figures for the standard dusts of lead arsenate or calcium arsenate and sulphur (1 : 5) and for a derris dust containing 0·5 per cent. rotenone being 31, 51 and 46 per cent. All other treatments were less effective. Although calcium arsenate reduced the number of infested buds more than lead arsenate when used with sulphur, it reduced the yield more, owing to severe plant injury ; with Celite and clay it resulted in an increase in yield in spite of injury to foliage and fruit. The barium fluosilicate dust caused slight browning of the margins of the leaves and the tips of the berries, and the cryolite no noticeable injury, the increase in yield for these two treatments over the control plots being 49 and 53 per cent., respectively.

Stearns (L. A.). **Experimental Spraying for Control of second-brood Codling Moth.**—*Trans. Peninsula hort. Soc. 1941* pp. 40–45, 25 refs. [Dover, Del.] 1942.

Experiments were carried out in Delaware in 1941 to determine the value of substitutes for arsenicals in the control of the second generation of the codling moth [*Cydia pomonella*, L.] on apple trees that had received a calyx and four cover sprays containing lead arsenate against the first generation. Applications were made on 10th and 24th July and 7th August of sprays containing the following ingredients per 100 U.S. gals. water : 3 lb. lead arsenate and Bordeaux mixture (1 lb. copper sulphate and 3 lb. hydrated lime) ; 3 lb. Black Leaf 155 (14 per cent. fixed nicotine) ; 1½ lb. Black Leaf 155 with 2 U.S. quarts oil (Orthol-K) emulsion ; 1½ U.S. pints D-X (a rotenone and pyrethrum product) ; or 2 lb. Genicide [containing xanthone (*cf. R.A.E.*, A **29** 411)] with supplementary materials mixed according to the manufacturer's directions. All the treatments gave approximately the same degree of protection against the second generation of *C. pomonella*, averages of 53·6–60·2 per cent. of the fruits being free from larvae or injury by them, but attack by the Japanese beetle [*Popillia japonica*, Newm.] was very severe in the orchard, and only the lead arsenate treatment prevented heavy feeding. Apples infested by larvae of the oriental fruit moth [*Cydia molesta*, Busck] were more numerous on one of the sprayed varieties (Jonathan) than those infested by *C. pomonella* ; they were included with the latter in recording the results of spraying.

Owing to unusually dry weather, arsenical residues were high, but they were satisfactorily removed by washing. All the alternative treatments resulted in residues well below the tolerance (0·025 grain As_2O_3 per lb. fruit), but they are much more expensive than lead arsenate and with the exception of Genicide cannot be combined with a copper fungicide. The spray containing this product as now marketed with supplementary agents is too complicated for practical use, and the author recommends the employment of lead arsenate and Bordeaux mixture if any disease is present and washing facilities are available, and Black Leaf 155 with Ortho-K emulsion otherwise.

A brief account of the codling moth research programme in the State since 1925 and a list of publications on the subject are appended.

Stearns (L. A.), Fassig (W. W.) & Beacher (J. H.). **Colonization of the Milky Disease of Japanese Beetle Larvae in Delaware. First Report.**—*Trans. Peninsula hort. Soc. 1941* pp. 46–51, 2 figs., 5 refs. [Dover, Del.] 1942.

In this first progress report on the attempted establishment of the type A milky disease, caused by *Bacillus popilliae* [*R.A.E.*, A **29** 369], amongst larvae of *Popillia japonica*, Newm., in Delaware, the importance and distribution of the beetle in the State and the use of artificial control measures are briefly discussed and the organisation of the scheme and the methods used in colonising the bacillus are described. About 2,300 lb. spore dust was distributed in 1941, and approximately 216,000 larvae were collected and inoculated to provide material for 1942.

Cory (E. N.), Graham (C.) & Ditman (L. P.). **Experiments of the Corn Ear Worm and the European Corn Borer.**—*Trans. Peninsula hort. Soc. 1941* pp. 94–96. [Dover, Del.] 1942.

The methods that have been tested for the control of the corn ear worm [*Heliothis armigera*, Hb.] on maize in Maryland include sprays against the eggs and larvae, poison baits, repellents and trap lights against the adults, mechanical barriers and desilking to prevent the entry of young larvae into the ear, and cultural measures, but none of them has been entirely successful. A slightly refined mineral oil containing 0·2 per cent. pyrethrins or 1–3 per cent. dichloroethyl ether, injected into the tips of the ears [*cf. R.A.E.*, A **30** 555, etc.] gave good kills of the larvae, but was expensive and dangerous if improperly applied ; the practical value of the method is briefly discussed. The fall army worm [*Laphygma frugiperda*, S. & A.], which attacks the ear at either end, cannot be controlled by this method.

Infestation of maize by the European corn borer [*Pyrausta nubilalis*, Hb.] on the Eastern shore was less severe in 1941 than in 1940 [**29** 505]. In experiments in which 12 maize hybrids were planted on five different dates between 13th May and 10th June, some gave good yields under conditions of moderate infestation, and the later plantings appeared to be less infested than the earlier ones.

Amos (J. M.). **Spraying Requirements for effective Control of Plum Curculio on Peaches in southern Delaware.**—*Trans. Peninsula hort. Soc. 1941* pp. 98–101, 1 fig., 1 ref. [Dover, Del.] 1942.

Experiments were carried out in southern Delaware in 1941 to determine the relative value of the petal fall, sepal and first cover sprays commonly used against *Conotrachelus nenuphar*, Hbst., on peach. The sprays contained 2 lb. lead arsenate, 4 lb. zinc sulphate and 5 lb. hydrated lime per 100 U.S. gals. water, with the addition of 8 lb. flotation sulphur paste in the second and third, and were applied on 21st April and 5th and 15th May at the rate of 1, 3 and 3 U.S. gals. per tree, respectively. Comparison of plots on which the first, second or third spray was omitted with plots receiving all three or none showed that the petal-fall spray was valueless, but that the omission of either of the others resulted in a marked increase in infestation. Examination of jarring data for 1930–41 indicated that adults are not active at petal fall unless maximum temperatures have been above 60°F. for a short period, and only under such conditions should a spray be applied at this time. The sepal and first cover sprays are considered to be equally effective in preventing early infestation in this region. Although infestation was light, fruit dropped from trees receiving the full spray schedule showed an average of 22 infested per tree, and it is therefore concluded that so many eggs are deposited in the growing fruits, in spite of the sprays applied, that under conditions of moderate to heavy infestation, dropped peaches must be picked up and destroyed to reduce pre-harvest injury and to keep the population at the lowest possible level.

MacCreary (D.) & Phillips (C. E.). **Facts concerning European Corn Borer of Interest to Delaware Farmers.**—*Trans. Peninsula hort. Soc. 1941* pp. 102–109, 2 refs. [Dover, Del.] 1942.

This paper includes information on the seasonal development of *Pyrausta nubilalis*, Hb., in Delaware, obtained in 1941, when the average percentage of maize plants infested was 24·9 [*cf. R.A.E.*, A **29** 508]. The emergence of overwintered adults began in early May, so that the destruction of larvae and pupae by the ploughing under or burning of crop remnants should be carried out not later than the end of the first week in May. Larvae of the first generation are relatively scarce in maize, feeding in early potatoes and other plants. In one field of maize, no *Pyrausta* larvae were found on 11th June, but a fairly heavy infestation of the southern cornstalk borer, *Diatraea crambidoides*, Grote, was present, whereas 44 per cent. of the plants examined were infested by *Pyrausta* on 6th August, and no *Diatraea* larvae were found. In sweet maize planted on 11th April and 4th June, 8 and 12, respectively, of 50 stalks were injured (some by *D. crambidoides* and others by some unknown agency), and no larvae of *P. nubilalis* were discovered, whereas in that planted on 15th July, 46 of 50 stalks were injured, 11 containing no larvae and 35 containing 35 larvae of *Laphygma frugiperda*, S. & A., 28 of *P. nubilalis*, 11 of *Heliothis armigera*, Hb., and one of *D. crambidoides*. Preliminary field trials with 28 hybrids and 3 open-pollinated varieties of maize indicated that a number of the hybrids will be more useful than the open-pollinated varieties, but further investigations are necessary before any of those tested can be recommended as resistant to *P. nubilalis* under Delaware conditions.

Glaser (R. W.), McCoy (E. E.) & Girth (H. B.). **The Biology and Culture of *Neoaplectana chresima*, a new Nematode parasitic in Insects.**—*J. Parasit.* **28** no. 2 pp. 123–126, 5 refs. Lancaster, Pa., 1942.

A few years ago, larvae of *Heliothis armigera*, Hb., that were dead or dying as a result of parasitism by a Nematode were found in New Jersey ; and between 1937 and 1940, the same parasite was found in larvae of *Popillia japonica*, Newm., in 14 localities in New Jersey and one in Maryland, in all of which it appeared to be reducing the population of the beetle considerably. Its distinguishing characters are described by G. Steiner, and it is named *Neoaplectana chresima*, sp. n. Other hosts that were experimentally infested with it were *Melanoplus* sp., *Pyrausta nubilalis*, Hb., and *Ceratomia catalpae*, Boisd. ; one dead larva of the last species contained more than a million second-stage Nematode larvae. Its life-cycle is similar to that of *N. glaseri* [*cf. R.A.E.*, A **29** 369], but the average number of young produced by the ovoviviparous females is 250–400 as compared with about 15. A method of culturing this species on fresh, sterile rabbit kidney or an autoclaved medium, the specifications for which are given, is described ; no growth is ordinarily obtained when contaminants are present, though several strains have developed and consistently yielded cultures on transplantation in the presence of one bacterium.

Gahan (A. B.). **Descriptions of five new Species of Chalcidoidea, with Notes on a few described Species (Hymenoptera).**—*Proc. U. S. nat. Mus.* **92** no. 3137 pp. 41–51, 2 refs. Washington, 1942.

The new species described include the Encyrtids, *Blepyrus saccharicola*, reared from *Pseudococcus* sp. on sugar-cane in Louisiana and Florida, and *Ooencyrtus anabrivorus*, from eggs of *Anabrus simplex*, Hald., in Wyoming. Comparison of specimens showed that the Pteromalid, *Trichomalus trujilloi*, Blanch. [*R.A.E.*, A **26** 582] is a synonym of *Dibrachys cavus*, Wlk. *Azotus silvestrii*, Comp. [**14** 580] is a synonym of *Ablerus perspeciosus*, Gir. [**9** 452], since the types were found to agree completely ; other examples of this

Aphelinid have been reared from *Aulacaspis* (*Diaspis*) *pentagona*, Targ., in the United States. Since the type of the Encyrtid, *Euryrhopalus schwarzi*, How., which is the genotype of *Euryrhopalus*, and paratypes of *Synaspidia pretiosa*, Timb., which is the genotype of *Synaspidia* [**13** 117], were found to agree in all generic characters, *Synaspidia* is congeneric with *Euryrhopalus*.

Swenk (M. H.) & Bratt (C. H.). **The Relation of Temperature to the embryonic and nymphal Development of the Differential Grasshopper** *Melanoplus differentialis* **Thomas.**—*Res. Bull. Neb. agric. Exp. Sta.* no. 122, 24 pp., 9 figs., 12 refs. Lincoln, Neb., 1941.

The following is based on the authors' summary of this account of experiments begun in Nebraska in 1936. Temperature is the major factor regulating the rate of embryonic development of *Melanoplus differentialis*, Thos. Eggs that have been sufficiently exposed to low temperatures develop without diapause and at an accelerated rate when returned to higher temperatures [*cf. R.A.E.*, A **25** 519]. Eighty freshly deposited egg pods collected during the latter part of October and kept at about 45°F. for 15 days exhibited great variation in subsequent mortality and rate of hatching at constant temperatures of 60, 65, 70, 75, 80, 85 and 90°F. The most favourable temperatures were 80 and 85°, at which the eggs developed rapidly and uniformly, without diapause, in 34–64 days. If rate of development and percentage of hatch are both considered, the optimum incubation temperature is 80°. The rate of development was reduced at temperatures below 80° and the percentage of hatch at those below 75° ; both varied directly with the temperature. At 60°, less than 40 per cent. of the eggs hatched, and these required 135–154 days to do so ; at 65°, over 85 per cent. hatched in 84–94 days ; and at 70–85°, over 91 per cent. hatched. At 90°, the hatching period was reduced to 42–45 days, but only 57·3 per cent. of the eggs hatched, since many shrivelled and succumbed to fungous infection.

The rate of development of the nymphs varied directly with the temperature, but 85°F. was the optimum for survival. At or below 65°, development was so retarded that all nymphs died. At 70°, some developed to the adult stage, in 105–112 days ; and at 75°, a fair number completed development, in spite of high mortality. Completion of development was general at 80°, in an average period of 48·5 days ; at the optimum temperature of 85°, the developmental period was 35–49 days ; and at 90°, the grasshoppers fed voraciously and almost constantly and grew very rapidly, but only one-third of them reached the adult stage, in 31–37 days.

This species normally has six nymphal instars, but some individuals underwent an extra moult in either the third or fourth regular instar, and where growth was proceeding rapidly at temperatures of 85°F. or higher, extra moults in both the third and fourth instars made a total of eight instars. The higher the developmental temperature, the lighter was the general coloration of the resulting adults.

Smucker (S. J.). *Scolytus sulcatus* **and Apple Trees in Relation to the Dutch Elm Disease Control Program.**—*Phytopathology* **32** no. 5 pp. 441–442, 1 fig., 3 refs. Lancaster, Pa., 1942.

It is known that *Scolytus sulcatus*, Lec., sometimes breeds in elm as well as in apple and can transmit *Ceratostomella ulmi* [*R.A.E.*, A **29** 119]. In a preliminary experiment to ascertain how long the fungus can survive in apple, 100 seedlings were inoculated with a spore suspension in June 1939. In September, 50 were cut and examined and all were infected. Their trunks were then placed

in dense shade ; *C. ulmi* was recovered from 19 in October 1940 and from 2 in March 1941, but had disappeared 6 months later. In September 1941, samples were cut from 10 of the remaining trees, and the fungus was recovered from 9 of them.

In the winter of 1940–41, samples of apple wood infested by *S. sulcatus* were collected from 32 points in New Jersey and New York within 1,000 ft. of sites from which elms infected with *C. ulmi* had been removed. Attempts were made to isolate the fungus from 535 representative maternal galleries and from 14,311 beetles that emerged from the infested material, but all were unsuccessful. It is therefore concluded that, though it can survive for considerable periods in apple trees, it is unlikely to be transmitted to or from them by *S. sulcatus* in nature and therefore that they are not of importance in connection with its spread in elms.

Snyder (W. C.). **A seed-borne Mosaic of Asparagus Bean,** *Vigna sesquipedalis*. —*Phytopathology* **32** no. 6 pp. 518–523, 2 figs., 9 refs. Lancaster, Pa., 1942.

A description is given of the symptoms of a mosaic disease that was observed in 1938 in asparagus bean (*Vigna unguiculata* var. *sesquipedalis*) grown from seed in the greenhouse. In experiments, the virus proved to be seed-borne and transmissible by the inoculation of juice. When non-infected examples of *Macrosiphum onobrychis*, Boy. (*pisi*, Kalt.) were allowed to feed for 2 days on diseased plants and were then transferred in batches of 10–25 to healthy ones, on which they were allowed to feed for 2 days before being destroyed, 10 of 14 plants became infected. No mosaic developed in control plants.

Smith (F. F.) & Weiss (F.). **Relationship of Insects to the Spread of Azalea Flower Spot.**—*Tech. Bull. U. S. Dep. Agric.* no. 798, 43 pp., 8 figs., 5 refs. Washington, D.C., 1942.

This bulletin comprises a detailed account of the experimental procedure and the results obtained in the studies that formed a basis for the conclusions drawn in a recent circular [*R.A.E.*, A **30** 49] on the flower-spot disease of azalea, caused by *Ovulinia azaleae*, in the United States. In tests with living insects of 15 species, transmission of the fungus was obtained with another species of *Bombus*, two other solitary bees, three ants and a fly, in addition to the insects previously recorded [*loc. cit.*].

Gilbertson (G. I.) & Horsfall (W. R.). **Blister Beetles and their Control.**— *Bull. S. Dak. agric. Exp. Sta.* no. 340, 23 pp., 10 figs., 14 refs. Brookings, S. Dak., 1940. [Recd. 1942.]

An account is given of the bionomics and economic importance of eight species of blister beetles that are common in South Dakota. The larvae of these Meloids prey on the eggs of grasshoppers, and the adults feed on a wide range of field, garden and ornamental plants, so that they are beneficial insects in range areas where there are few cultivated crops and pests in areas that are principally cultivated. All the species dealt with have similar bionomics. The female deposits 50–300 eggs in a compact mass in a hole in the ground ; the larvae hatch in an average of 9–37 days, depending on the species, and usually remain in the egg cavity for 1–3 days. On leaving the soil, the larva runs about actively, often for a week or more, until it finds a grasshopper egg-mass, which it enters, beginning to feed immediately. It moults within a few days and subsequently at intervals of about 1–2 days, each of the earlier instars being less active than the previous one. In the fifth instar, the larva burrows

into the soil after it has finished feeding and makes a hibernation chamber. In some species, the fifth instar is sometimes followed by the pupal stage, but in most cases there is a sixth larval instar, in which the larva remains quiescent for the rest of the year and often for two or more years, and a seventh active, non-feeding instar before the pupal stage.

Macrobasis immaculata, Say, was very abundant and injurious to potatoes in the central and south-central parts of the State during 1934–38 ; it has a wide range of food-plants including sweet clover [*Melilotus*], lucerne and many kinds of vegetables. The adults are present between mid-June and late August, and seem to be gregarious ; they feed voraciously for 7–10 days before mating, and oviposition begins about 15–21 days later, after a period of minimum feeding. The larvae attack the eggs of several species of grasshoppers, chiefly *Melanoplus bivittatus*, Say, and *M. differentialis*, Thos. ; they remain in the sixth instar throughout the winter, until warm weather in late spring ; the seventh instar and pupal stage last 8–15 and 10–14 days, respectively, and the life-cycle usually lasts one year. *Epicauta lemniscata*, F., is most abundant in the south-east of the State and in most of the Sioux River Valley, and like *Macrobasis immaculata*, often causes total loss of potato crops when it occurs in large numbers. It is less numerous, however, than the latter, and the number of food-plants is limited. There is a tendency for some of the larvae to pupate after the fifth instar. *E. maculata*, Say, occurs throughout the State and has been destructive during years of grasshopper outbreaks, particularly east of the Missouri River ; the preferred food-plant is potato, others being soy bean, lucerne and sweet clover. Injury to potato is less severe than that caused by the first two species, but is persistent and widespread. Adults are present from early June to August and are not gregarious. The larvae attack the eggs of small grasshoppers, particularly *Melanoplus mexicanus*, Sauss. There is usually one generation in the year, though some individuals emerge during the year in which they develop. *Macrobasis unicolor*, Kby., and *M. murina*, Lec., are distributed throughout the State and are most important in the potato-growing region, though the flowers of sweet clover and lucerne are preferred as food. Adults are present from May or June until August, and there is usually one generation in the year. Larvae of *M. unicolor* occasionally pupated after the fifth instar when reared in the laboratory. *M. segmentata*, Say, has been destructive, particularly to potatoes in dry seasons, but Russian thistle [*Salsola*] is the usual food-plant ; the larvae attack the eggs of *Melanoplus mexicanus*, *M. bivittatus* and *M. differentialis*. *Henous confertus*, Say, has a limited range in South Dakota and is not known to have caused damage there. *E. callosa*, Lec., has not been observed to damage crops, sunflower [*Helianthus*], which grows abundantly on uncultivated land, being the only known food-plant ; grasshoppers of which the eggs are attacked by the larvae include *M. mexicanus*.

Blister beetles often do a great deal of damage before they are detected, and are not readily killed by the usual stomach poisons, arsenicals acting rather as repellents. A dust of 1 part barium fluosilicate and 3–4 parts flour has given the best control, particularly in gardens and on sugar-beet and potato, and caused no scorching on market garden crops, though tree seedlings were slightly injured ; it must be applied whenever the beetles appear. Thorough spraying under high pressure with Bordeaux mixture (4 : 6 : 50) to which Paris green has been added at the rate of 2–3 lb. per 100 U.S. gals. gives fair control on potato.

McGregor (E. A.). **The taxonomic Status of the so-called "Common Red Spider."**—*Proc. ent. Soc. Wash.* **44** no. 2 pp. 26–29, 6 figs., 5 refs. Washington, D.C., 1942.

The author describes the characters distinguishing the males of the mite commonly known as *Tetranychus telarius*, L., for which he considers *T. althaeae*, v. Hanst., to be the correct name [*cf. R.A.E.*, A **13** 3–4], and the lime-tree

mite [*T. tiliarius*, Herm.], which is the species that he considers to be *T. telarius* [*loc. cit.*], from each other and from *T. bimaculatus*, Harvey.

In the course of the routine work of identifying spinning mites, he has accumulated data on the species occurring throughout the United States. *T. tiliarius* has never been identified from America, but both *T. telarius* (*althaeae*) and *T. bimaculatus* have frequently been received from many localities in the United States and from Canada, and *T. telarius* also from Hawaii. It is uncertain which is the commoner in the United States.

Boyce (A. M.), Korsmeier (R. B.) & Persing (C. O.). **The Citrus Bud Mite and its Control.**—*Calif. Citrogr.* **27** no. 5 pp. 124–125, 134, 136–138, 140–141, 15 figs., 4 refs. Los Angeles, Calif., 1942.

Much of the information in this paper on the history and distribution of *Eriophyes sheldoni*, Ewing, the injury it causes to *Citrus*, particularly to lemon, and its bionomics and control in California has been noticed from another source [*R.A.E.*, A **30** 429]. In the course of experiments on control, it was found that the ordinary concentration of light-medium oil (1·67–2 per cent.) was as effective as the equivalent concentration of heavier oils against mites in the buds of lemon, but the medium and heavy-medium oils appeared to be rather more effective against those under the buttons of the fruit. Extra light oil (viscosity approximately 45 secs. Saybolt) at 4 per cent. was less effective, and 10 per cent. kerosene (95 per cent. unsulphonatable residue) was useless. The most promising of the sulphur treatments tested were sprays containing 8–12 lb. 325-mesh sulphur or 2 U.S. gals. lime-sulphur and 4 lb. sulphur per 100 U.S. gals. water, with 2 oz. Grasselli spreader-sticker (a liquid preparation of sodium oleyl sulphate and synthetic resin) or 8 oz. calcium-caseinate spreader, and an inverted mixture of 0·5 per cent. emulsive oil with 4 lb. sulphur and 0·25–2 oz. blood-albumin spreader per 100 U.S. gals. water, all of which were appreciably more effective than the light-medium oil, but of little value against other pests of *Citrus* [*cf. loc. cit.*]. A spray of 1·5 U.S. gals. ammonium polysulphide with 0·33 U.S. gals. oil and 2 oz. casein per 100 U.S. gals. water was less effective, but less injurious to the trees at high temperatures than the other sulphur treatments, and tests indicated that several carefully timed applications of sulphur dust may give considerable control.

Although the mites develop continuously throughout the year, the proportion of infested buds has increased extremely rapidly during June–August in recent years, probably owing to migration of mites on the trees. The amount of damage is not sufficient to justify special treatment, however, provided that the population is reduced to a low level in early autumn and late winter or spring. Treatment is particularly necessary before winter, when the amount of new growth and buds available is usually limited, since the most serious injury to buds occurs when large numbers of mites are present for a relatively long time; a full dosage of oil (1·67–2 per cent.) is the most practical when the control of *E. sheldoni* is the major consideration. The spring treatment should be applied when not more than 20–30 per cent. of the buds are infested; if a second application of the oil spray is not feasible, one of the sulphur treatments, or 0·75–1 per cent. light-medium oil with rotenone [*cf.* **30** 430] should be used. *E. sheldoni* became important on a limited acreage of oranges during 1941, and an application of a light-medium oil spray (1·67 per cent.) during autumn gave good control and will probably protect the trees fairly well for about a year; it is likely that the sulphur preparations used on lemon will also be effective on orange. Nursery stock, including seedlings in the seed bed, should be treated with 2 per cent. light-medium oil several times a year; balled nursery trees should be immersed in a dip containing 2 per cent. oil and prepared with an emulsion of the mayonnaise type. Newly planted trees in infested orchards should be sprayed with 1·67 per cent. light-medium oil several times a year for at least two years, in order to obtain the maximum quantity of normal growth.

MACKIE (D. B.) & others. **Bureau of Entomology and Plant Quarantine.**—*Bull. Dep. Agric. Calif.* **30** (1941) no. 4 pp. 337–373. Sacramento, Calif., 1942.

In 1941, attempts to eradicate the citrus white fly [*Dialeurodes citri*, Ril. & How.], *Lepidosaphes* (*Nilotaspis*) *halli*, Green, and *Chrysomphalus* (*Melanaspis*) *obscurus*, Comst., were continued in California [*cf. R.A.E.*, A **30** 307], and investigations with a view to a campaign for the eradication of the olive parlatoria scale [*Parlatoria oleae*, Colv.] were begun. *L. halli* infests the leaves, fruit and branches of stone fruit trees and was found on a single plant of *Spiraea veitchii*; the bark on the trunks and main branches of the trees was scraped, and sprays containing 1·67 per cent. oil (70 secs. viscosity, 90 per cent. unsulphonated residue), in the form of an emulsion with a suitable spreader, were applied in May, July and September over the entire area known to be infested. Large pecan trees infested with *C. obscurus* [*cf. loc. cit.*] were cut back and fumigated on 13th January and 9th March with hydrocyanic acid gas at a dosage of 36 cc. per 100 cu. ft. *P. oleae* is known to occur in five counties and is probably more widespread than was previously believed. It appears to be a potentially serious pest of deciduous fruit trees, of which it attacks leaves, branches and fruit, and can build up its population on a wide variety of foodplants, including peach and plum. Fumigation gave considerable control on olive.

Grasshoppers were less numerous than in the previous year [*cf.* **30** 308], and control by natural agencies was more effective in many counties. Their numbers were affected by uneven and unseasonal rainfall, and the long dry autumn appeared to delay the oviposition of the devastator grasshopper [*Melanoplus mexicanus devastator*, Scud.] and reduced the population of egg-laying females in many districts; Sarcophagid parasites were more abundant in the San Joaquin Valley than previously. Tests indicated that bands of hoppers congregated on weed clumps can be exterminated with dusts containing dinitro-cresol, which, however, is expensive. There was a decrease in the population of field crickets [*Gryllulus assimilis*, F.], though some damage occurred to melon plantings in two counties. *Clinopleura melanopleura*, Scud., increased in the Sacramento and San Joaquin valleys and adjoining foothills and caused some damage to crops and range land; this Tettigoniid did not feed readily on poisoned bran baits. *Anabrus simplex*, Hald., appeared in California for the third successive year, but has caused no measurable loss.

Diabrotica trivittata, Mannh., the twelve-spotted cucumber beetle [*D. duodecimpunctata*, F.], the western twelve-spotted cucumber beetle [*D. undecimpunctata*, Mannh.] and the belted cucumber beetle [*D. balteata*, Lec.] caused considerable loss of fruit, vegetables and ornamental plants; these beetles were controlled by dusts containing 1 per cent. each of organic thiocyanate and pyrethrins, which were best applied in strips across the direction of wind currents. The alfalfa caterpillar [*Colias eurytheme*, Boisd.] was injurious to lucerne over 250,000 acres between the lower Sacramento Valley and the Mexican border, but caused rather less damage than in 1940. The variegated cutworm [*Peridroma saucia*, Hb.] attacked young stands of lucerne, *Citrus*, sugar beet and vetch over wide areas, but was successfully controlled by dusts of calcium arsenate or cryolite. *Lygus* spp. injured lucerne, cotton and potato in the southern part of the San Joaquin valley. The pea Aphid [*Macrosiphum onobrychis*, Boy.] did considerable damage to spring-harvested peas in the lower Sacramento Valley, and was not controlled by treatment with dusts containing rotenone or nicotine, owing to its rapid reproduction. The population of the codling moth [*Cydia pomonella*, L.] was lower than for several years, though infestation of stone fruit was considerably higher in the lower San Joaquin Valley and the foothills of the Sacramento Valley; in some cases infestation occurred in orchards removed from pome-fruit plantings. Large areas of olive were fumigated with hydrocyanic acid gas, for the control of Coccids, particularly

black scale [*Saissetia oleae*, Bern.], *Parlatoria oleae* and ivy scale [*Aspidiotus hederae*, Vall.], of which the last is the most resistant to fumigation. *Metaphycus helvolus*, Comp., a parasite of *S. oleae*, was liberated in four counties. On grape-vines, the leaf-hopper [*Erythroneura comes*, Say] was less numerous than usual; calcium cyanide dust was applied against it by aeroplane. The grape leaf-roller [*Desmia funeralis*, Hb.] has caused losses in two counties for four years and became important over an increasing area in 1941; parasitism by *Microbracon cushmani*, Mues., was high but did not give control, and dusting with cryolite was not entirely satisfactory.

Miscellaneous pests identified during the year included the mite, *Oxypleurites maxwelli*, Keifer, which damaged developing olive shoots; the red scale [*Aonidiella aurantii*, Mask.], which was taken on unusual food-plants, such as *Camellia*, camphor and *Cotoneaster*; *Bruchus rufimanus*, Boh., small adults of which were reared from vetch seed; *Ephestia elutella*, Hb., and *Aphomia gularis*, Zell., in dried prunes; and *Eriophyes tulipae*, Keifer [*cf.* **26** 650], which was found to be common in Mexican and Texas garlic and onion bulbs. The use of oil dips is necessary for the eradication of the citrus bud mite, *Eriophyes sheldoni*, Ewing, on nursery stock [*cf.* preceding abstract], as fumigation is not completely lethal to the egg stage.

Notes on revisions of quarantine regulations against a number of insect pests, and lists of injurious insects intercepted at maritime and air ports, at border inspection stations and within the State or found in nurseries are appended.

Steinweden (J. B.), Mackie (D. B.), Carter (W. B.) & Smith (S. S.). **A single Treatment for *Gladiolus* Corms to destroy all Stages of the *Gladiolus* Thrips.**—*Bull. Dep. Agric. Calif.* **31** no. 1 pp. 31–39, 2 figs., 5 refs. Sacramento, Calif., 1942.

The authors briefly review the history and bionomics of *Taeniothrips simplex*, Morison, and its importance and distribution on *Gladiolus* in California. Several methods are used to control the thrips in the stored corms [*cf. R.A.E.*, A **23** 757; **24** 249; **30** 306], but none has proved entirely satisfactory, owing largely to the sheltered site of the eggs, which in some cases necessitates repeated or prolonged treatment. Experiments were carried out in California in 1941 on its control in corms by fumigation with methyl bromide and on the effect of this treatment on the germination and blossom yield of the plants. The results of unpublished work by F. M. Fletcher and E. M. Lynn are incorporated.

The following is based on the authors' summary. Of the various schedules that gave complete mortality of all stages of the thrips, the lowest were fumigation with 12 oz. methyl bromide per 1,000 cu. ft. for 5 hours or 1½ lb. for 3 hours at 70°F., and 2 lb. for 3 hours or 3 lb. for 2 hours at 80°F. Fumigation at the higher temperature is recommended. The temperature of the corms and of the fumigation chamber should reach 80°F. before the gas is injected and should be maintained at that level during the exposure period. The relative humidity of the chamber should be at least 60 per cent. There was some stimulation of growth and blossoming of plants from corms fumigated with 3 lb. methyl bromide for 2 or 2½ hours. Schedules below these seemed to have no stimulating effect, while higher ones may have caused a slight retardation and weakening of the plants.

Turner (N.) & Horsfall (J. G.). **Meeting the Spray Material Shortage.**—*Bull. Conn. agric. Exp. Sta.* no. 455 pp. 170–179, 1 ref. New Haven, Conn., 1942.

In view of the reduction in supplies of certain materials used as insecticides and fungicides in the United States and the probable shortage of others, suggestions are made for the most economical use of available materials with special

reference to the crops grown in Connecticut. These include the elimination of treatments on non-essential crops and ornamental plants and possible reductions on essential crops of which the quality but not the yield is affected, improved timing of applications, the elimination of merely protective treatments and improved coverage by applying dusts solely to plants wet with dew and sprays through large nozzles. The larger nozzle results in a coarser spray that penetrates to the inner leaves, and the increased consumption of spray can be offset by reducing its concentration. Investigations have shown that the reductions in control consequent on the use of equal amounts of sprays and dusts of lower concentration are not great. A reduction of 50 per cent. in the concentration of the materials used for the control of 16 insects and diseases would result in only about 5 per cent. decrease in control. The actual percentage decreases for reductions of 50 and 90 per cent. in concentration are shown in a table. It is concluded therefore that it is better to apply a treatment at reduced concentration to the whole of a crop rather than the full concentration to only a part of it. In some cases, alternative materials are available. Thus, pyrethrum can be substituted for rotenone for the control of certain insect pests. There is no good substitute for lead arsenate on fruit trees, but considerable economy in this material would result from the use of alternative substances in sprays against the Japanese beetle [*Popillia japonica*, Newm.] on ornamental plants and the discontinuance of soil treatments against the larvae in lawns.

Wilson (H. F.) & Janes (R. L.). **Lower Concentrations of Rotenone.**—*Soap* **18** no. 3 pp. 93–95, 117. New York, N.Y., 1942. **Carriers of Rotenone Dusts.**—*T.c.* no. 4 pp. 103, 105.

In the first of these papers, the authors describe investigations carried out with cubé dusts in Wisconsin, which showed that clay and many talcs are incompatible with rotenone, and in the second they further discuss the results obtained. These indicate that the failure in the past to secure consistent control of insects with derris or cubé dusts has been due mainly to the use of unsuitable diluents and methods of application. With a suitable carrier and conditioned with soy-bean or lubricating oil, the dusts were highly toxic to the pea Aphid [*Macrosiphum onobrychis*, Boy.], but when an incompatible talc was used, the toxic value was reduced by the physical or chemical action of the diluent, giving poor and inconsistent results. Of 22 samples of talc and three of pyrophyllite from different deposits in the United States, only five talcs and one pyrophyllite (sold as Pyrax ABB) were highly compatible with rotenone. The differences between the diluents appeared to depend largely on particle shape, chemical composition and the electrostatic charge developed in the process of applying the finished dust [*cf. R.A.E.*, A **29** 569]; particle size did not appear to be of great importance, and the effect of hardness is not known, since though diluents that develop the highest electrostatic charges in mixed dusts cause abrasion, this may be due either to hardness or to the presence of particles of free silica.

There was no significant difference in the percentages of control of *M. onobrychis* on potted pea plants in the greenhouse given by freshly mixed cubé dusts diluted with Pyrax to contain from 0·1 to 0·75 per cent. rotenone and conditioned with 2 per cent. lubricating oil, and in 53 greenhouse experiments, carried out during the winters of 1939–42, dusts containing 0·1 per cent. rotenone averaged 92·05 per cent. control. It is not known whether such low concentrations are advisable in the field, but concentrations of 0·25–0·5 per cent. were as effective as higher ones in field tests. A dust containing 0·1 per cent. rotenone was effective against the asparagus beetle [*Crioceris asparagi*, L.].

The results indicated that better control is obtained with larger amounts of a dust of low rotenone content than with smaller amounts of a more concentrated one, that vegetable oils may be less satisfactory than mineral oils in dusts that are stored for a long time, and that temperature has less effect on control than

humidity. Equipment and methods of dusting are briefly discussed; better dispersion was obtained when the nozzle of the duster was held 12–15 ins. from the plants than when it was held within 8–10 ins. of them. It is concluded that dusts containing rotenone cannot give complete control of the Aphid, owing to the rapidity of reproduction and the slow action of the poison.

CRESSMAN (A. W.) & DAWSEY (L. H.). **Insecticidal Efficiency of some Oils of Plant Origin.**—*Tech. Bull. U. S. Dep. Agric.* no. 801, 15 pp., 4 graphs, 13 refs. Washington, D.C., 1942.

The following is substantially the authors' summary. The insecticidal efficiencies of a number of oils of plant origin have been compared with that of a refined petroleum oil. Emulsions were prepared by mixing these oils with ground bone glue. Nymphs of *Phenacoccus gossypii*, Tns. & Ckll., reared on potted chrysanthemum plants in the greenhouse, were sprayed in the laboratory. Mature females and eggs of *Chionaspis salicis-nigrae*, Walsh, on willow twigs, and eggs of *Tortrix* (*Cacoecia*) *argyrospila*, Wlk., on apple twigs, were collected in the field and brought into the laboratory for treatment. Adult females of *Lepidosaphes ulmi*, L., on willow were sprayed in the field with a power sprayer.

Crude maize oil was equal or superior to the petroleum oil in tests on *P. gossypii* in which dosage-mortality curves were determined and comparisons made on the basis of equivalent oil deposits. In tests with adult females of *C. salicis-nigrae* and *L. ulmi*, crude maize oil gave a higher kill and heavier oil deposits than equivalent concentrations of the petroleum oil, deposits of the former oil against *C. salicis-nigrae* being more than twice as great. In the tests with these two Coccids, the percentage of survival increased with the density of population. Crude cottonseed and ground-nut oils were equal or superior to petroleum oil in tests on *P. gossypii*; refined maize oil was less effective than the petroleum oil against *P. gossypii* and *L. ulmi*. Refined cottonseed oil was not so effective as the petroleum oil against *P. gossypii*, and the addition of cottonseed fatty acid did not increase the toxicity. A mixture of coconut oil and petroleum oil gave smaller oil deposits and lower mortality of the mealybugs than an equivalent concentration of petroleum oil. Orange oil and pine oil had little effect on it and severely injured chrysanthemum plants, and these oils were so volatile that the initial spray deposits were soon lost. Tests on eggs of *C. salicis-nigrae* and *T. argyrospila* indicated that the ovicidal effects of the oils used were closely correlated with their drying properties. Ground-nut oil, a non-drying oil, was superior to the other vegetable oils, but less effective than the petroleum oil. Crude and refined maize oil and refined cottonseed oil, all of which are semi-drying, were relatively ineffective.

Deposits of crude maize oil ranged from 60 to more than 100 per cent. higher than those obtained from equivalent concentrations of the other oils. In most cases there was little difference in deposits of petroleum, ground-nut, refined maize, refined cottonseed and crude cottonseed oils. Results of plant-injury tests were so variable that it was concluded that plant tolerance to the different oils would have to be determined on the same plants and under the conditions prevailing when these materials are used in practice. Vegetable oils generally cost more than petroleum oil, but they possess superior solvent action for certain organic insecticides.

WILKES (A.). **The Influence of Selection on the Preferendum of a Chalcid (*Microplectron fuscipennis* Zett.) and its Significance in the biological Control of an Insect Pest.**—*Proc. roy. Soc.* (B) **130** no. 861 pp. 400–415, 5 graphs, 14 refs. London, 1942.

Microplectron fuscipenne, Zett., has been liberated against *Gilpinia hercyniae*, Htg. (*polytoma*, auct.) on spruce in widely separated areas in Canada,

but its establishment and increase have been considerably more successful in some areas than in others. When the climatic and ecological field data were studied in the light of preliminary laboratory tests, it appeared that these differences might be associated with definite preferences for certain temperatures on the part of the parasites. Previous work on temperature preferences exhibited by insects is briefly reviewed and indicates marked variations in the temperatures preferred by individual species under different circumstances. The temperature preferences of *M. fuscipenne* were therefore investigated to determine the possible existence and application in pest control of intra-specific groups into which individuals might be isolated by means of temperature preferences. The apparatus, comprising an insulated copper trough heated at one end and cooled at the other to provide a continuous temperature gradient, and the technique adopted in the tests are described.

In the rearing of *M. fuscipenne* for release, extensive laboratory propagation is carried out from May to September. Adults of both sexes reared at 23°C. [73·4°F.] and placed in the trough at about the middle of their breeding season showed a marked preference for temperatures between 20 and 30°C. [68 and 86°F.]. Of the total number, 60–70 per cent. congregated within this range, most at about 25°C. [77°F.], but smaller groups gathered at temperatures about 15 and 8°C. [59 and 46·4°F.]. The range of temperatures preferred by parasites tested in May, June and August became progressively wider. In May, most females congregated between 17 and 23°C. [62·6 and 73·4°F.], but those developing later again showed preferences for temperatures about 8, 15 and 25°C., and in August, almost equal numbers occurred at 8 and 25°C. and the number at 15°C. was only slightly smaller. These seasonal differences are attributed to the fact that only a small maintenance stock of closely inbred parasites was kept until May, of which only those of each generation that emerged first from the host were used for breeding ; this selective breeding at 23°C. for several generations reduced the number of individuals preferring low temperatures, but when random breeding from a larger stock was introduced, the three groups reappeared. In 1939 and 1940, experiments were made with selected stock bred over two generations in the first year and 12 in the next from females showing a preference for temperatures of 6–10°C. [42·8–50°F.]. Individuals of the first selected generation showed a marked preference for the lower temperatures of the gradient ; the three main groups were still present, but not more than 50 per cent. of the parasites gathered at 25°C. In the fourth and subsequent generations, the percentage of individuals showing a marked preference for temperatures below 10°C. increased from 3 in the normal populations to 40 ; the group at 25°C. persisted, becoming smaller in each succeeding generation, but that at 15°C. was very variable. It is thought possible that groups with other temperature preferences may exist.

The changes in the temperatures preferred by *M. fuscipenne* were not related to seasonal or previous temperature experiences, and the groups noted appear to be genetic in origin. The results of the study are discussed with reference to general questions of the behaviour of parasites, including the factors attracting them to the habitat of their host, which are believed to include temperature. The temperature in the moss on the forest floor in which the cocoons of *G. hercyniae* are habitually spun is considerably lower than that of the air, and if it is lower than that preferred by the parasite, the cocoons may not be attacked. The temperatures preferred by parasites collected from an area in the Gaspé peninsula where the mean temperature is low and where they had been established for some years were found to resemble closely those of the selected stock, the percentage preferring temperatures below 15°C. being 55 instead of 22 as in the normal stock. The parasites liberated in the cool heavily wooded districts of the Gaspé and in southern New Brunswick and the warmer parts of the Gaspé were all from the same stock, but whereas they quickly became established in the latter areas and parasitism there may be as high as 50 to 60 per cent., in

the former establishment was slow and the percentage parasitism rarely exceeds 2–4. The author points out that failure to find the host owing to unfavourable temperatures may result in the elimination of small colonies and retard the development of parasite populations, and suggests that the breeding of strains with specific temperature preferences might result in effective establishment and rapid increase of parasites liberated for pest control.

Wolcott (G. N.) & Martorell (L. F.). **The accidental Introduction of a beneficial Insect into Puerto Rico.**—*Caribb. Forester* **3** no. 2 pp. 58–60. Rio Piedras, P.R., 1942.

This paper includes records of the finding in Porto Rico of the predacious larvae of the Elaterid, *Chalcolepidius silbermanni*, Chevr., in cavities in a log of *Bursera simaruba* that had been infested by the Lamiid, *Lagochirus araneiformis*, L., and in a log of *Albizzia lebbek* infested by larvae of *Elaphidion* spp. It is considered that this Elaterid must have been introduced into Porto Rico in timber from the Dominican Republic, where it is common.

Callan (E. McC.). **Notes on** *Theresia claripalpis* **Wulp (Diptera, Tachinidae), a Parasite of** *Diatraea* **spp. in Trinidad, B.W.I.**—*Trop. Agriculture* **19** no. 4 pp. 71–73. Trinidad, 1942.

The species of *Diatraea* that infest sugar-cane in Trinidad are *D. impersonatella*, Wlk., which is the most important, especially in the south, *D. canella*, Hmps., which is more abundant in the north than in the south, and *D. saccharalis*, F., which is comparatively rare but is commoner in mature canes than in young shoots. The larvae of *Diatraea* spp. are parasitised by the indigenous Tachinids, *Theresia claripalpis*, Wulp, and *Stomatodexia diadema*, Wied., of which the former is the more important and shows a definite preference for *D. impersonatella* and *D. saccharalis* over *D. canella*.

Since the life-histories and habits of *Diatraea* spp. and *Pyrausta nubilalis*, Hb., are very similar, it was considered possible that the parasites of the former in Trinidad might attack the latter in Canada. The chance that these parasites would become acclimatised in Canada was remote, but it was thought that this difficulty might be overcome by the selection of strains suited to the Canadian climate. Arrangements were therefore made in 1941 for *T. claripalpis* to be collected in Trinidad and sent by air to Canada. In all, 315 puparia of the Tachinid were shipped to Canada. The method of packing them is described. Adults emerged on arrival, and they paired in the laboratory. One generation was bred on *P. nubilalis*, thus showing that *T. claripalpis* can reproduce on this host. The parasites for shipment were all obtained from one estate by the dissection of " dead hearts " ; no mature cane was cut. Any free parasite larvae or puparia were removed, and the *Diatraea* larvae transferred to tubes containing pieces of cane. Parasite larvae and puparia were removed as they appeared. From the 18,497 " dead hearts " dissected, 4,232 *Diatraea* larvae were obtained, of which 69·2, 29·8 and 1 per cent. were *D. impersonatella*, *D. canella* and *D. saccharalis*, respectively. Of the 399 examples of *T. claripalpis* obtained, 231 were field collected, while 159, 5 and 4 were bred from *D. impersonatella*, *D. canella* and *D. saccharalis*, respectively, giving percentages of parasitism of 5·4, 0·4 and 8·9. The puparia were kept in cool storage at 65–75°F. prior to shipment.

T. claripalpis was the only Tachinid parasite bred from *Diatraea* spp. on the estate, neither *S. diadema* nor *Metagonistylum minense*, Tns., which was introduced into Trinidad in 1936 and 1937 [*cf. R.A.E.*, A **27** 24] and released in this locality, being obtained ; it is concluded, therefore, that *M. minense* has not become established there.

FENNAH (R. G.). **The "Orange Moth" of Dominica, B.W.I.**—*Trop. Agriculture* **19** no. 4 pp. 73–78, 11 figs. Trinidad, 1942.

Since 1910, a Tortricid identified as *Gymnandrosoma* sp., probably undescribed, has been observed from time to time attacking fruits of *Citrus*, including orange, sweet lime and tangerine, in the uplands of Dominica. The larvae bore into the developing fruits and afford entry for fungi, which cause yellowing of the skin round the point of entry and subsequent shedding. Investigations were made by the author during a series of visits from 1938 to 1941, and it was found that an apparent preference for certain varieties was determined by accident of situation, all heavily infested trees being at the edge of the forest, close beneath the fringe of the canopy. The chief food-plant of the Tortricid was a forest tree, *Simaruba amara*. All stages are described.

The eggs are deposited singly on the surface of the immature fruits, usually only one on a single fruit, though as many as four have been observed. In *Simaruba* fruits, the larva bores immediately into the pulp and later into the seed, in which it feeds on the cotyledons, but on oranges the newly hatched larva wanders about the fruit, sometimes for several hours, before entering; many apparently fall off or migrate down the stalk, and in an experiment, no entries were observed until a shallow trough was cut on the surface of the fruit. Most of the larvae in oranges are drowned by the juice or by the gum that exudes from the pith at the point of injury. Surviving larvae bore to the rag in the centre; the fruit has generally fallen by this time and rapidly decays if it is large, and the larvae then move freely about the decaying mass. In small dry fruits they pupate in the feeding tunnel. The percentage of larval mortality in fruits of orange and *Simaruba* averaged 92 and 90, respectively. The egg, larval and pupal stages lasted 5 and about 21 and 14 days, and about 99 per cent. of the pupae give rise to adults. The latter survive for only a few days. An undescribed species of *Microdus* (*Bassus*) was reared from larvae infesting fruits of *Simaruba*, but the percentage parasitism did not exceed 5.

A survey showed that very few of the available females oviposit on *Citrus*, and only those trees that are most frequently encountered by dispersing moths are seriously infested. The removal of all *Simaruba* growing within 100 yards of *Citrus* was recommended for control, and surveys of an estate so treated showed that infestation of orange had ceased.

[WATERSTON (J. M.).] **Plant Pathology.**—*Rep. Dep. Agric. Bermuda 1941* pp. 8–9. [Hamilton] Bermuda, 1942.

Damage to potato tubers by *Gnorimoschema* (*Phthorimaea*) *operculella*, Zell., was less severe in Bermuda in 1941 than in previous years [*cf. R.A.E.*, A **30** 167], principally because few tubers were stored during the summer. Precautions against the introduction of *Popillia japonica*, Newm., were continued; no adults were taken in traps during the summer, but in August two living beetles were found on a steamship from New York and another on a steamship from New Jersey. Minor pests included *Agromyza pusilla*, Mg., which attacked crucifer seedlings during the autumn; *Trialeurodes vaporariorum*, Westw., on fiddlewood (*Citharexylum spinosum*), *Duranta repens*, guava, garden rose and myrtle (*Myrtus communis*); *Xylopsocus capucinus*, F., which bored in moribund and dead limbs of *Poinciana* (*Delonix*) *regia*; *Kalotermes approximatus*, Snyder, which attacked *Bougainvillea spectabilis* and *Ficus elastica*; *Ligyrus tumulosus*, Burm., which tunnelled the stems of tomato below ground level; and *Aulacaspis pentagona*, Targ., which occurred on the ornamental plant, *Leonotis leonurus*.

Insect Pests.—*Agric. Gaz. N.S.W.* **53** pt. 2 pp. 100–104, 3 figs. Sydney, 1942.

This part of a series on insect pests in New South Wales [*cf. R.A.E.*, A **30** 498] includes notes on the bionomics and control of *Tenebroides mauritanicus*,

L., which infests stored grain and cereal products and is also predacious on other insects in them. Both the adults and the larvae overwinter, and in cold climates adults are the more abundant during the late spring and early summer. The life-cycle lasts 9–19 weeks, but if the larva hibernates it may last 39–59 weeks. Under favourable conditions there may be two generations a year. The full-fed larvae wander in search of pupation sites, and sometimes pupate in crevices or bore into soft wood to do so. For this reason, hardwoods should be used for the construction of bins or other containers, and the timbers should be closely fitted. The eggs and pupae are readily killed by low temperatures, but the larvae and adults can survive for several weeks at a temperature of 15–20°F. Heating materials to a temperature of 120–130°F. for at least one hour kills all insects present. In cases of severe infestation, fumigation with carbon bisulphide or hydrocyanic acid gas is recommended.

LAVOIPIERRE (M. M. J.). **Further Studies on the Acari of South Africa.**—*J. N. U. C. sci. Soc.* **2** pp. 26–30, 4 refs. Pietermaritzburg, 1941.

The author reports that detailed examination of a Tetranychid mite found on a snake and one that was common on the upper surface of leaves of mulberry (*Morus alba*) at Durban showed that they belonged to the same species. Brief notes on the appearance of the different stages are given. The only other known case of a Tetranychid infesting both animals and plants is that of *Tetranychus molestissimus*, Weyenb. [*cf. R.A.E.*, B **28** 50]. Small numbers of females of the Tarsonemid described in 1909 as *Pediculopsis graminum*, Reut., were found on sugar-cane in Natal. The author transfers this species to the genus *Pediculoides*, as he has received a letter from A. C. Oudemans, expressing the opinion that both *Pediculopsis* and *Pygmephorus* are congeneric with the latter. Observations on mites found parasitising wild bees in Natal are appended.

HATTINGH (C. C.). **The Biology and Ecology of the Army Worm** (*Laphygma exempta*) **and its Control in South Africa.**—*Sci. Bull. Dep. Agric. For. S. Afr.* no. 217, 50 pp., 7 pls. (2 col.), 2 figs., 9 graphs, 11 refs. Pretoria, 1941.

The author describes all stages of *Laphygma exempta*, Wlk., which is one of the most important pests of pastures, forage grasses and cereals in South Africa, together with characters distinguishing the larva from that of *L. exigua*, Hb., gives an account of its life-history, based on detailed laboratory studies and observations in the field, and discusses its distribution, importance and control. This Noctuid periodically causes extensive damage in areas that have rain in summer and are subject to exceptionally high temperatures; such large outbreaks have been comparatively rare, but small ones, which are seldom of economic importance, occur every year, generally towards the end of the summer, during January–March or sometimes April, when practically no recovery of the plants is possible. Only graminaceous plants are attacked; the newly-hatched larvae, which are strongly attracted to light, migrate to the growing tips and skeletonise the young growth; larvae in the fourth, fifth and sixth instars eat all but mature growth. Pupation takes place in patches of sand or decaying vegetation or under clods and stones.

It was found that temperatures of at least 70°F. for a few weeks and also abundant succulent grass for the young larvae [*cf. R.A.E.*, A **28** 191] were necessary for an outbreak to occur; oviposition and larval growth increased considerably at 85–90°F. and decreased below 70°F. Contrary to general opinion, the insect does not remain in the pupal stage for long periods, the moths cannot migrate very far before ovipositing, since the pre-oviposition period is usually about two days and they fly only at night, and they may oviposit at the place of emergence. Graphs in which the normal rainfall and that during outbreak years are compared indicate that outbreaks occur after drought during October, November and sometimes December, followed by heavy rains in December or

January, which result in succulent grass in January–March, when temperatures are favourable for the army worm. In areas where the growing season is unusually long, they occur after dry weather in March, followed by heavy rains, which cause the grass to shoot, and high temperatures ; and they have also been observed after severe hail, followed by hot weather, causing the destruction of mature grass and the growth of new shoots. Conditions favourable to an outbreak are created by burning the grass during March, just before the lambing season, by overstocking or by mowing pastures, all of which result in abundant young grass. Outbreaks are usually reported from the northern districts earlier than from the south, which is probably due to hotter weather, resulting in more rapid development and spread. It was found, however, that small infestations occurred in the south at the same time as the large ones in the north. From the data available, the author concludes that *L. exempta*, which is able to exist under widely different climatic conditions, is always present in the outbreak areas, though sometimes in negligible numbers, and only becomes destructive when the temperature and food supply are suitable. It is unlikely that either the larvae or the adults migrate for long distances, and it has not been proved that the latter travel in swarms.

During years when outbreaks are expected, careful search should be made for small patches of plants with skeletonised leaves, which may be infested by young larvae. In uncultivated areas, patches of sweet grasses, such as *Cynodon dactylon*, should be kept under observation, as outbreaks usually start on these ; in cultivated areas, they may begin on patches of sweet annual grasses, or very young maize or wheat. Control by the use of rollers is not very effective except on lawns or roads ; larvae in small patches can be crushed by driving sheep backwards and forwards over them. The advance of columns of larvae can be checked by ploughing a furrow about 8–12 ins. deep at right angles to their course and killing the larvae that fall in by dragging a heavy log along the furrow, spraying them with a solution of sodium arsenite (0·5 per cent.) or flooding the furrows with water ; barriers of coal tar were successful, but expensive, as they had to be renewed every day. Baits of 100 lb. wheat bran, 4 lb. white arsenic or sodium arsenite and 4 gals. treacle mixed with about 10–12 gals. water and spread at the rate of 60–75 lb. per acre, and of cut green maize stalks sprayed with a solution of 1 lb. sodium arsenite and 1 gal. treacle in 10 gals. water were very effective against the larvae ; since the attractiveness of a bait depends largely on its moisture content, it should be spread towards sunset, unless the larvae are very short of food, when it may be applied at any time. When the baits are used against migrating larvae, they should be spread in ploughed furrows, so that what is left can be covered with soil, to minimise the danger to stock. Spraying with stomach poisons, such as lead arsenate or Paris green, was ineffective. Cryolite dust, applied at a rate equivalent to 10 lb. per acre, gave complete control of the larvae in the laboratory, and was very effective against those feeding on crops or pasture in the field ; a dust of equal quantities of cryolite and talc, applied at 15 lb. per acre, was less satisfactory. Dusting should be carried out before sunrise, and repeated if rain falls within 12 hours. Cryolite dust is of little use against migrating larvae, as they do not feed much.

HATTINGH (C. C.). **Preliminary Studies on the Control of the Gladiolus Thrips (*Taeniothrips simplex*) in the Transvaal.**—*Sci. Bull. Dep. Agric. For. S. Afr.* no. 221, 16 pp., 9 figs., 6 refs. Pretoria, 1940. [Recd. 1942.]

The author reviews from the literature the life-history of *Taeniothrips simplex*, Morison, on *Gladiolus* [*cf. R.A.E.*, A **23** 3] and the numerous plants on which breeding occurs or adults have been taken. In the Transvaal, the thrips occurs in large numbers only in hot dry weather and causes very little damage in winter. The injury to leaves and flowers is described. Migration has been stated to occur only from *Gladiolus* that is in flower, when the tissues

harden, and this was confirmed by observation of the thrips that were present on comparatively young *Gladiolus* and on neighbouring flowering plants in a large field in December 1938. Lists are given of the species found. Considerable migration to *Gladiolus* probably occurs when the wild food-plants are reaching maturity.

The results are given of field tests carried out near Pretoria in 1936–38 with various mixtures of water-soluble stomach poisons, contact insecticides and spreaders, and of laboratory tests with contact sprays, of which nicotine sulphate (1 : 300) was the most effective, and with stomach poisons, of which calcium chloracetate (0·5 per cent.) and white arsenic (0·5 per cent.) gave by far the best control of the thrips, but were too injurious to the foliage to be practicable. Since Paris green (1 : 800) with molasses has been shown to give rapid and effective control [*cf.* **23** 2], a spray containing $\frac{3}{4}$ oz. Paris green, 20 fl. oz. molasses, 2 fl. oz. nicotine sulphate and $\frac{1}{8}$ oz. spreader in 4 gals. water was tested in the field in September 1938. Plants treated once a week from the time they were 6 ins. high showed practically no thrips injury at the end of November, when those in the control plots were severely damaged ; injury to foliage by the spray was considerably reduced by applying it in the late afternoon. These results were confirmed by growers who used the spray regularly. Although thrips have rarely been found on the stored corms in the Transvaal, the author recommends that these should be stored at low temperatures, fumigated or dipped in a solution of corrosive sublimate (mercury bichloride) or hot water [*cf.* **23** 4 ; **24** 249], unless they are known to be free from infestation ; methods of fumigation include storing corms dusted with nicotine (2 per cent.) in closed bins for three weeks. As considerable migration of thrips occurs from maturing and flowering plants to younger ones, plants of different ages should be well separated. Spraying with the recommended mixture should begin when the plants are 4–6 ins. high and be carried out once a week until the first buds open ; the spray should be applied as a fine mist to all growing parts of the plants.

Cherian (M. C.) & Kylasam (M. S.). **Preliminary Studies on the Cardamom Thrips (*Taeniothrips cardamomi* Ramk.), and its Control.**—*Madras agric. J.* **29** no. 9 pp. 355–359, 4 refs. Madras, 1941.

Infestation of cardamom [*Elettaria cardamomum*] by *Taeniothrips cardamomi*, Ram. Ayyar, has steadily increased in southern India since 1934, when it was first observed [*cf. R.A.E.*, A **23** 745], 75–80 per cent. of the fruit examined from one estate in the Anamalai Hills showing injury in 1939 [*cf.* **30** 559]. The thrips is found in all the cardamom-growing areas ; it breeds throughout the year on this food-plant, the population being lowest in November–January and reaching a peak in May and June, at the time of maximum flowering. Adults and nymphs occur in various protected situations on the plant, but prepupae and pupae only within the perianth and leaf sheaths.

Investigations on control were begun in 1939 when the plants were treated in the last week of May with sulphur dust or with sprays containing tobacco extract and soft soap (0·028 per cent. nicotine), 0·5 per cent. Bordeaux mixture with coconut oil as an adhesive, or 1 lb. potash fish-oil soap in 6 gals. water. The sprays were applied at the rate of 1,400 gals. per acre. Examination of the capsules, which were picked on 13th October and 10th November 1939 and 15th January and 15th February 1940, showed that the tobacco spray was the only treatment that gave a significant increase in the percentage of capsules of good quality. This increase was significant in the third picking, and in all pickings considered together, but not in the other three pickings considered separately. It appears, therefore, that earlier and later applications are also required ; most of the capsules in the first two pickings had set before the spray was applied.

Annual Report of the Imperial Council of Agricultural Research 1940-41.—ii+190 pp., 10 pls. Delhi, 1942.

The section on entomology (pp. 34–36) includes notes on insect pests observed in the Punjab and the North-West Frontier Province during the year ending 31st March 1941. The San José scale [*Aspidiotus perniciosus*, Comst.] was present on fruit trees and other plants and infested 30 per cent. of the apple fruits from Kashmir; it is usually spread on nursery stock. Observations showed that the crawlers produced on a fruit migrate on the ground for up to 12 ft. *Dialeurodes citri*, Ril. & How., *Aonidiella aurantii*, Mask., and the Psyllid, *Diaphorina citri*, Kuway., were widely distributed on *Citrus*, and the Coccid also occurred on jaman [*Eugenia cumini* (*jambolana*)] and rose. Mango hoppers [*Idiocerus* spp.] were major pests of mango wherever it was grown. Apple orchards in the Kulu Valley and the Simla Hills were infested with the woolly aphis [*Eriosoma lanigerum*, Hsm.], but its parasite, *Aphelinus mali*, Hald., has become well established there [*cf. R.A.E.*, A **28** 561; **30** 457]. Apples were also attacked by the Lamiid, *Apriona cinerea*, Chevr., and the codling moth [*Cydia pomonella*, L.], peaches by the Aphid, *Anuraphis padi*, L. (*Brachycaudus pruni*, auct.), and various fruit trees by the Galerucid, *Mimastra cyanura*, Hope, which skeletonised the leaves.

Investigations on the Cecidomyiid, *Pachydiplosis oryzae*, Wood-Mason, which causes the condition known as gangai or silvery shoot of rice, showed that the larvae destroy the growing point, a gall being produced instead of the stem that bears the ear. To safeguard the crop from serious damage, early local varieties should be grown by the transplantation method at a period earlier than usual, and plant growth should be stimulated by fertilisers. The adults are attracted to light-traps. This Cecidomyiid was parasitised by two Chalcidoids and *Platygaster* sp. [*cf.* **27** 577].

In the section on pathology (p. 36), it is stated that *Hibiscus esculentus* was infested by Aphids, especially during the monsoon, and by *Empoasca devastans*, Dist., and another Jassid. The virus of yellow-vein mosaic of this plant was found to be transmitted by *Bemisia tabaci*, Gennadius (*gossypiperda*, Misra & Lamba) and by grafting, but not by sap inoculation or through the seed. Leaf-curl of chillies [*Capsicum*] was shown to be caused by the feeding of *Scirtothrips dorsalis*, Hood, on young leaves, and not by a virus. The virus of rugose mosaic of tomatos and that causing a yellow mosaic of lima beans (*Phaseolus lunatus*) were transmitted by Aleurodids.

Barnes (H. F.). **Studies on Fluctuations in Insect Populations. IX. The Carrot-fly** (*Psila rosae*) **in 1936-41.**—*J. Anim. Ecol.* **11** no. 1 pp. 69–81, 1 pl., 3 graphs, 5 refs. London, 1942.

An account is given of investigations carried out during 1936–41 to determine a method of estimating the yearly abundance, degree of parasitism and emergence dates of the carrot fly, *Psila rosae*, F. Second-generation larvae and pupae were collected in north Lincolnshire and east Nottinghamshire each year during February and early March, and reared in an unheated outdoor insectary in Hertfordshire. The collections were made from the soil below stored carrots, from carrots still in the ground, and on one occasion from the soil from which carrots had just been lifted, and the numbers of larvae and pupae obtained in a given time were used to assess variations in the abundance of the fly. The method of sampling is discussed and the data obtained are given in tables and graphs. Since the ratio of larvae to puparia was very variable, ranging from 92 : 8 to 3 : 97, it is concluded that the collections were made at the time at which pupation generally occurs. There appeared to be no close relationship between the date of pupation and that of the emergence of adults, and this is not thought to be due to the difference in localities of collection and rearing. The percentage

emergence from material collected in Lincolnshire varied between 81 and 94 in every year except one, when it was very low, and that from Nottinghamshire between 63 and 98. The low figures are thought to be due to the presence, in an incipient stage, of a disease that attacked the larvae and in one year the puparia, causing them to turn black, and seemed to be most prevalent in excessively damp seasons. The ratio of males to females varied from 39 : 61 to 52 : 48 in Lincolnshire and from 34 : 64 to 49 : 51 in Nottinghamshire. Emergence from material from both countries extended in general from the second half of April until July or early August, and reached a peak about 14th May; in 1939 and 1941 the peak was a little later in material from Nottinghamshire than in that from Lincolnshire. In some years there were indications of a minor secondary peak about the third week in June. The percentage parasitism was low in most years, varying from about 1 to 10 except in 1940, when it was about 26 in Lincolnshire and 20 in Nottinghamshire, where parasitism was always slightly lower. With the exception of two individuals, the only parasite concerned was *Dacnusa postica*, Hal.

The author considers that the method of sampling is justified by the results and that the preparation of standard emergence tables for this fly is possible. He suggests the establishment of an insect phenological station to enable growers to be informed each year of the standard dates of emergence, etc., of insect pests the control of which depends on exact timing, from which the local dates could be estimated from previous experience.

Control of *P. rosae* appears to be possible during the pre-oviposition period, which lasts nearly two weeks and during which the adults are numerous at the place of emergence, and also when the larvae and puparia are concentrated in the soil beneath stored carrots. Emergence from pots of soil containing larvae and puparia was considerably reduced by watering the soil on 8th May first with a solution containing 1 per cent. formalin (40 per cent.) and then with water, whereas the emergence of parasites appeared to be unaffected. The treatment did not appear to delay the emergence of either flies or parasites, and the possibility is suggested of controlling *P. rosae* by watering the bases of clamps, etc., with a solution of formalin when the carrots are removed in spring.

Fox-Wilson (G.). **The Lily Beetle,** *Crioceris lilii* **Scop.**—*J. R. hort. Soc.* **67** pt. 5 pp. 165–168, 1 pl., 11 refs. London, 1942.

Lilioceris (*Crioceris*) *lilii*, Scop., was observed in Surrey in May 1940, when it caused considerable injury to the foliage of *Lilium regale, L. tigrinum* and *Fritillaria*, and in 1941. Other food-plants were *L. giganteum* and *Polygonatum*. Outbreaks of this Criocerid, which occurs throughout Europe and in North Africa, are sporadic in the British Isles, into which it is introduced with imported lily bulbs and packing material. The adults and larvae are capable of causing very severe damage to the foliage and flowering shoots of liliaceous plants. The adult, larva and egg are briefly described, and its bionomics and food-plants are discussed from the literature [*R.A.E.*, A **27** 267, etc.]. In Surrey, adults were still numerous at the beginning of September 1941; no parasites were reared in either year. The beetle is easily controlled by a lead-arsenate spray or a nicotine dust.

Fox-Wilson (G.). **Aphides, with special Reference to their Control.**—*J. R. hort. Soc.* **67** pt. 6 pp. 199–205, 2 pls., 3 refs. London, 1942.

A popular account is given of the ways in which the control of Aphids is affected by the manner in which they reproduce, overwinter and migrate. The insecticides commonly used against them are reviewed, and recommendations are made for their control on fruit trees, vegetables and ornamental plants.

CAMPBELL (W. G.). **The Relationship between Nitrogen Metabolism and the Duration of the larval Stage of the Death-watch Beetle** (*Xestobium rufovillosum* **De G.) reared in Wood decayed by Fungi.**—*Biochem. J.* **35** no. 10–11 pp. 1200–1208, 3 figs., 13 refs. London, 1941.

The following is based on the author's summary of this investigation of the effect of fungus decay on the nutritional value of wood for larvae of *Xestobium rufovillosum*, DeG. [*cf. R.A.E.*, A **30** 270]. Nitrogen estimations on samples of oak sapwood decayed to various stages by *Phellinus cryptarum* showed that the fungus removes a considerable proportion of the wood nitrogen via the mycelium that grows on the exterior of the test pieces. After removal of the external mycelium, the decayed test pieces had significantly higher nitrogen content than sound wood of similar origin, but the rate of increase in nitrogen content of the wood residue during progressive decay was not great. Specimens that had lost approximately 50 per cent. of their original weight by decay might contain, on the average, some 10 per cent. more nitrogen than sound wood. The nitrogen content of the frass of *X. rufovillosum* reared in oak sapwood decayed by *P. cryptarum* was compared in three separate instances with that of the original decayed wood, and no significant differences were found between the two quantities on a percentage basis.

It is concluded that the growing *Xestobium* larva retains in its body at least 95 per cent., and probably all, of the nitrogen available to it in the wood that it digests, and consequently that the rate of intake of nitrogen is a determinant of the duration of the larval stage. The nitrogen in decayed wood, as opposed to less decayed or sound wood, is made more available to the *Xestobium* larva by the softening effect produced by decay on the substrate. Less resistance is thereby encountered to boring, and the duration of the larval stage decreases accordingly.

BECKER (G.). **Beobachtungen und experimentelle Untersuchungen zur Kenntnis des Mulmbockkäfers** (*Ergates faber* **L.). 1. Schädlichkeit, Käfer, Eiablage und Eientwicklung, Puppenstadium.** [Observations and experimental Investigations on *E. faber*. 1. Harmfulness, Adult, Oviposition and Egg Development, pupal Stage.]— *Z. angew. Ent.* **29** pt. 1 pp. 1–30, 20 figs., 38 refs. Berlin, 1942.

Both *Hylotrupes bajulus*, L., and *Anobium punctatum*, DeG., have been used in tests in Germany on wood-preservatives [*cf. R.A.E.*, A **27** 202–204], but in view of the divergent reactions of the larvae to environment and toxic materials it has been found desirable to include other species. *Ergates faber*, L., was selected as a common wood-destroying beetle, and an account is given of preliminary investigations on its biology. The larvae of this Prionid live in dead coniferous wood, and infest tree stumps, where they are associated with other Coleopterous larvae. In Germany, they are commonest in pine wood, but have also been recorded from spruce, fir [*Abies*] and larch. Infestation is beneficial in rotting stumps, as it hastens their destruction, but harmful in stored or worked timber [*cf.* **26** 301]. Damage has been recorded in telegraph poles [**24** 740] and fencing, and the author describes damage to timber in buildings, usually horizontal beams where the lodgement of water had caused dampness of the wood. Infestation is prevented if the wood is not allowed to become damp.

The adults and egg are described. In Brandenburg, the adults emerge from early July to mid-August, males about a week earlier than females, and leave the wood after a few days through the exit-hole prepared by the larva. They are nocturnal in habit and usually hide by day. They need warmth and preferred a ground temperature of about 42°C. [107·6°F.]. Oviposition did not take place at air temperatures below 22–23°C. [71·6–73·4°F.]. High atmospheric humidity increased adult activity. In captivity, beetles gnawed through wood, paper and cardboard, but did not ingest the material, and records

show that they are able to gnaw through lead sheeting. Adult life averaged 21 days at room temperature (20–26°C. [68–78·8°F.]). Oviposition occurs mostly at night and the female appears to be guided to suitable wood by scent. Experiments on olfactory stimuli showed that certain essential oils of conifers, chiefly pinenes, and some coal-tar products, such as creosote, attract the beetles and cause them to leave their shelters by day. The eggs were laid over several days in batches of up to 61 and the numbers laid per female ranged from 174 to 275. The duration of the egg stage was dependent on temperature and ranged from an average of 12·1 days at 35°C. [95°F.] and 89–93 per cent. relative humidity to one of 43·5 days at 18°C. [64·4°F.] and 90–93 per cent. No eggs hatched at 40°C. [104°F.], and the percentage mortality was least (0) at 28·1°C. [82·58°F.] and 10–12 per cent. relative humidity. The weight of the newly hatched larvae varied directly with the length of the parent females, and observations on naturally infested timber indicated that the larval stage lasts 7–8 or as much as 12 years. Pupation takes place in a chamber, which is usually constructed in the sapwood, and the pupal stage lasts 3–4 weeks. High atmospheric humidity and temperatures as high as 28°C. [82·4°F.] are harmful to the pupae.

MARCUS (B. A.). **Ueber das Wachstum der Kiefer nach starkem Eulenfrass.** [On the Growth of Pines after serious Injury by the Pine Noctuid.]—*Z. angew. Ent.* **29** pt. 1 pp. 31–84, 25 figs., 43 refs. Berlin, 1942.

An examination in 1938 of pines in Bavaria that had been severely defoliated by *Panolis flammea*, Schiff., in 1928–1930 showed that trees that had been completely stripped were healthy and covered with needles. There was no notable difference in this respect between pines on moorland soil and those on sandy soil, but pines in dense stands still showed the effects of defoliation after seven years. Pines standing quite free resumed normal growth most quickly, especially as regards volume-increment, though this did not compensate for the loss due to defoliation. As a rule, this loss corresponded to a growth period of 5–7 years ; in trees 134 years old it represented one of 2–2½ years.

SCHAERFFENBERG (B.). **Die Elateridenlarven der Kiefernwaldstreu.** [The Elaterid Larvae in Pine Forest Litter.]—*Z. angew. Ent.* **29** pt. 1 pp. 85–115, 33 figs., 21 refs. Berlin, 1942.

In view of the observation that many pupae of *Bupalus piniarius*, L., in pine forests in Germany are destroyed by Elaterid larvae, a study was made to determine the species responsible and their relative importance. For this purpose samples of the ground litter from pine stands in Mecklenburg were examined, and records are given of the species found and of feeding experiments with them. The only species of importance in the destruction of the pupae were *Dolopius marginatus*, L., which was the commonest Elaterid in both mixed and unmixed stands, *Athous subfuscus*, Müll., which was the next commonest, and *Corymbites* (*Selatosomus*) *aeneus*, L. *Prosternon tessellatum*, L. (*holosericeum*, Ol.) was the only exclusively predacious species, but it was too rare to be of importance. The majority of the Elaterids were predominantly saprophagous, roots and insects being a secondary food. Though the pupae of *B. piniarius* were readily eaten, they formed an important item of diet only when abundant. Living roots were readily eaten only in dry weather and if humus was lacking. A key to the Elaterid larvae that occur in forests is appended.

ENGEL (H.). **Ueber die Populationsbewegung des Kiefernspanners** (*Bupalus piniarius* **L.) in verschiedenen Bestandstypen.** [On Fluctuation in the Abundance of *B. piniarius* in different Types of Stands.]—*Z. angew. Ent.* **29** pt. 1 pp. 116–163, 24 figs., 22 refs. Berlin, 1942.

The following is based on the author's summary of this paper in which observations carried out in 1936–38 in a pine forest in northern Germany during

an outbreak of *Bupalus piniarius*, L., are recorded in detail. They covered two generations in stands of unmixed pine in which the trees were of the same age, unmixed pine in which the trees were of different ages, and mixed pine and oak. The outbreak followed much the same course in stands of all three types, but the increase in population was greatest in the first and least in the third. The increase was limited predominantly by biotic factors, among which predacious bugs, spiders and beetles were the most important. Ichneumonid and Tachinid parasites operated only when the population had already been notably reduced by other agencies. Abiotic factors, such as heavy rains, were of only local importance. Natural enemies were relatively more numerous as compared with the population of the Geometrid in the unmixed than in the mixed stands, but during the collapse of the outbreak the decrease in its numbers was greater in the latter than in the former. This was due to the fact that alternative hosts were available in the mixed stands but not in the unmixed ones. Natural enemies are normally not numerous in unmixed stands, so that the moth is able to increase rapidly and reach higher levels of population than in stands of other types. The increase in natural enemies follows slowly, but when it become sufficiently great it causes a more rapid reduction of an outbreak than occurs in mixed stands.

JAHN (E.). *Chlorochroa pinicola* **M + R. Beitrag zur Morphologie und Lebensweise sowie zur Kenntnis des Lebensvereines von** *Chlorochroa pinicola* **M + R (Heteroptera, Pentatomidae).** [*C. pinicola*, Muls. & Rey. A Contribution to the Morphology and Biology and to the Knowledge of the Biocoenosis of *C. pinicola*.]—*Z. angew. Ent.* **29** pt. 1 pp. 164–175, 6 figs., 12 refs. Berlin, 1942.

Nymphs of *Chlorochroa pinicola*, Muls. & Rey, became unusually common during a recent outbreak of the Geometrid, *Bupalus piniarius*, L., on pine in West Slovakia [*cf. R.A.E.*, A **30** 540], and the eggs of this Pentatomid were in some cases more abundant than those of the moth. Experiments showed that the nymphs fed on the eggs and the first- and second-instar larvae ; they did not attack the larvae unless the latter were inactive, as they were when newly hatched, when moulting or when numb with cold. It was apparent that the bug was only occasionally predacious and is only of limited value in control. It was very resistant to contact poisons containing dinitro-ortho-cresol. The egg and nymph and the appearance of the egg batches, which contained about 14 eggs, are described. The eggs were parasitised by the Scelionids, *Telenomus truncatus*, Nees, *Microphanurus semistriatus*, Nees, and *M. schimitscheki*, a species recently described by Szelényi, whose description is quoted.

PAPERS NOTICED BY TITLE ONLY.

JANNONE (G.). **Studio morphologico, anatomico e istologico del** *Dociostaurus maroccanus* **(Thunb.) nelle sue fasi** *transiens congregans, gregaria* **e** *solitaria*. [Morphological, anatomical and histological Study of *D. maroccanus* in its Phases *transiens congregans, gregaria* and *solitaria*.]—*Boll. Lab. Ent. agr. Portici* **4** pp. 1–443, 150 figs., 14 pp. refs. Portici, 1939. [Recd. 1942.]

YEAGER (J. F.) & MUNSON (S. C.). **Changes induced in the Blood Cells of the Southern Armyworm** *Prodenia* [*Laphygma*] *eridania* **by the Administration of Poisons.**—*J. agric. Res.* **64** no. 6 pp. 307–332, 9 pls., 9 figs., 32 refs. Washington, D.C., 1942.

ROARK (R. C.). **Review of United States Patents relating to Pest Control** [January–June 1942] **15** nos. 1–6 ; 8, 11, 11, 10, 14, 10 pp. multigraph. [Washington, D.C.] U.S. Dep. Agric. Bur. Ent., 1942.

DRAKE (C. J.). **Bibliography of the State Plant Pest Laws, Quarantines, Regulations and Administrative Rulings of the United States of America.**—[1+] 60 pp., multigraph. [Ames, Iowa, 1942.]

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